

Commercial Fisheries Abstracts

a monthly summary of important developments
for the fishery industries

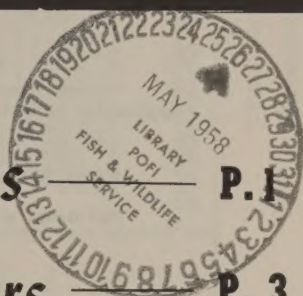
In this issue ~

- Holding Live Lobsters — **P. 1**
 - Holding Fresh Oysters — **P. 3**
 - Fish-Icing Techniques — **P. 5**
 - Radiation Pasteurization — **P. 9**
 - Bone Detection by X-Ray — **P. 19**
- ~ and 35 others*

Vol. 11 No. 4

April 1958

Fish and Wildlife Service
U.S. Department of the Interior
Washington D.C.





Commercial Fisheries Abstracts



*Prepared in the Division of Industrial Research and Services
Bureau of Commercial Fisheries*

EDITORIAL STAFF

Donald Y. Aska, Chief, Branch of Market Development
Maurice E. Stansby, Chief, Pacific Coast and Alaska Technological Research
F. Bruce Sanford, Chemist
Kathryn L. Osterhaug, Fishery Products Technologist
Martin J. Heerdt, Chemist
Gladys K. Chandler, Editorial Clerk (Typist)

Applications for **COMMERCIAL FISHERIES ABSTRACTS**, which is mailed free to members of the fishery industries and allied interests, should be addressed to the

Director, Bureau of Commercial Fisheries, United States Department of the Interior, Washington, 25, D. C.

Fulfillment of foreign requests confined to Government agencies, research institutions, and libraries.

The Service assumes no responsibility for the accuracy of material from outside sources, and can fulfill requests for copies of the articles only if the abstract was taken from a Service publication. Readers should direct requests for other articles to the author of the article or to the publication in which it appeared. The addresses of these publications are available from the Bureau of Commercial Fisheries, Washington 25, D. C.

The abstracts in this leaflet may be left in their present form; but it is suggested that to make the most efficient use of them, they be cut on the lines designated and filed by the number in the upper left-hand corner of each. For a full description of this filing system see "Fishery Technological Abstract Card System" by Maurice E. Stansby and K. L. Osterhaug, Fishery Leaflet No. 232, obtainable free by request from Bureau of Commercial Fisheries, Washington 25, D. C.

In addition to the regular abstracts, there is included a bibliography of references of secondary importance (without abstracts). These may be cut off on the lines designated and pasted on standard 3 x 5-inch cards for filing.

Following is a brief outline of this filing system. The numbers apply to the first digit appearing on each card. For the meaning of subsequent digits, please see the above described leaflet.

- | | |
|---------------------------|----------------------|
| 0 General and theoretical | 5 Vitamins |
| 1 Fish by species | 6 Fishery byproducts |
| 2 Fresh fish | 7 Analytical Methods |
| 3 Preserved fish | 8 Composition |
| 4 Oils | 9 Miscellaneous |

0. 5 RESPIRATORY CHARACTERISTICS OF MARINE BACTERIA

Merkel, Joseph R. (College of Charleston, Charleston, South Carolina); Carlucci, Angelo F.; and Pramer, David (Rutgers University, New Brunswick, New Jersey)
Nature 180, 1489-1490 (December 28, 1957)

Bacteria which are isolated from marine environments and require for growth a medium containing sea water are classified as true marine organisms. Recent evidence indicates that the inability of marine bacteria to grow in the absence of sea water is due to a requirement for specific inorganic ions. A second, but not as well-defined, characteristic of marine bacteria is their high proteolytic activity and their rapid growth on organic nitrogen compounds.

The majority of studies of the metabolic activities of marine bacteria are concerned with requirements for growth. Seldom have the respiratory characteristics of a marine bacterium been investigated and correlated with growth studies. It was therefore of interest to determine if the criteria used for distinguishing marine bacteria as a group are satisfied by respiratory as well as growth characteristics.

The respiratory activity of a marine bacterium and *Escherichia coli* on endogenous and exogenous substrates, in the absence and presence of sea water, was determined using a Warburg respirometer and conventional manometric procedures. The marine bacterium used in these studies was isolated from sea water collected in the vicinity of Fort Johnson. The growth requirements of the organism fulfill the criteria for its designation as a true marine bacterium. The culture is identified as A-11-3B1 in the Fort Johnson collection.

Oxygen uptake by the marine bacterium on both endogenous and exogenous substrates was much greater in sea water than in phosphate buffer. With *E. coli*, conditions were reversed, that is, oxygen uptake on both endogenous and exogenous substrates was greater in phosphate buffer than in sea water. These results should indicate that the reduced oxidation of glucose by *E. coli* in sea water was not the result of a deficiency of phosphate.

(over)

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4 PAGE 1
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

Reprinted in part

1. 37 FREEZING IS FINE SCIENCE AT WORLD'S LARGEST TROUT HATCHERY

Anonymous
Quick Frozen Foods 20, 50-51, 117 (November 1957)

A 10-acre trout ranch on the Snake River, the world's largest trout hatchery and the world's primary packer of frozen trout, is expected to produce 750,000 pounds of that delicacy during 1957.

The company produced Rocky Mountain Rainbow trout from the egg to table-market size and also grades, dresses, sharp-freezes, glazes, and packages the fish in six institutional sizes and two retail sizes.

Trout eggs are hatched in specially constructed troughs from November through March. The company, which utilizes scientific feeding, reported that its trout grow at the rate of 1 inch per month.

Approximately 300,000 eggs are required to produce 100,000 pounds of trout, and about 2 pounds of fish feed is required to produce every pound of trout gained.

In 1954, it took an average of 14 months to grow a trout to marketable size. Today, the Rainbow trout the customer receives from the hatchery plant are between 10 and 12 months of age.

Trout are caught, dressed, glazed, and placed in the freezer within 30 minutes by the following process:

The trout are seined and placed into individual grading boxes while still alive. The fish then are taken to the processing room of the plant where they are eviscerated, or dressed.

(over)

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4 PAGE 1
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

ABSTRACTER: Kathryn L. Osterhaug

RESPIRATION OF MARINE BACTERIA

TROUT FARMING

1. 87

HOW TEMPERATURE AND CROWDING AFFECT THE HOLDING OF LOBSTERS IN ARTIFICIAL SEA WATER

Wilder, D. G. and McLeece, D. W. (Fishery Biological Station, St. Andrews, New Brunswick)
Fisheries Research Board of Canada, Progress Reports of the Atlantic Coast Stations No. 66, 24-25 (September 1957)

Artificial sea water suitable for live lobsters can be prepared easily by dissolving five readily available salts in tap water. Storage and display tanks that hold from 50 to 500 pounds of live lobsters in artificial sea water are now being used quite extensively in inland markets. These tanks vary from simple inexpensive wooden structures to elaborate glass and stainless-steel units. All require a device to aerate the water. Some of the more elaborate tanks provide mechanical refrigeration, aeration of water, and filtration of the water. Lobsters will remain active and suitable for display over long periods of time if desirable water conditions are maintained in the holding tank. The temperature of the water, the salinity of the water, and the oxygen content of the water must be held within a limited range for conditions to be suitable.

Frequently the lobster holding units are operated under crowded conditions so that waste products from the lobsters accumulate and cause the water to become murky and finally toxic. Unless water in this condition is replaced, the lobsters will weaken and die. The accumulation of toxic materials can be retarded by filtering out waste products as they are formed, but even then the water must be changed occasionally to avoid its becoming toxic.

Purpose. -- This study was made to obtain more information on the effect of water temperature and crowding on the healthy condition of the lobsters.

Effect of temperature. -- Fifty lobsters weighing a total of 50 pounds were held in 50 Imperial (over)

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4 PAGE 1
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

ABSTRACTER: Martin Heerd

2. 00 STUDIES ON JELLIED MEAT OF SWORDFISH II. NUMERICAL CHANGE OF PARASITIC GERMS IN THE JELLIED MEAT OF SWORDFISH DURING COLD STORAGE

Tsuchiya, Yasuhiko and Kudo, Hidero (Tohoku University, Sendai, Japan)
The Tohoku Journal of Agricultural Research 7, 347-349 (March 1957) (In English)

Jellied meat of swordfish contains a large amount of moisture and a small amount of fat compared with the normal meat of swordfish. In addition, a large amount of water soluble nitrogen, especially from amino acid nitrogen, is derived from the digestion of the protein of the jellied meat of swordfish muscle. Jellied meat of swordfish is not comparable to spoiled meat of swordfish because of values of volatile basic nitrogen for the jellied meat are below 20 milligram percent and values of pH are 5.7 to 5.8. Jellied meat of swordfish, therefore, may be considered as a disordered meat that was liquified primarily by cathepsin or other similar enzymes of the parasite *Chloromyxum* and possibly in part by trypsin from spoilage bacteria.

Parasites in the jellied meat of swordfish appeared to decrease after the meat was held for several months in the cold storage. If this finding could be verified, freezing and cold storage immediately after catching might be used to reduce the jelling of swordfish meat or even to exterminate the parasites that exist in the meat.

Purpose. -- A study was made to determine changes in the numbers of *Chloromyxum* parasites in the jellied meat of swordfish during cold storage.

Experimental. -- Jellied meat from swordfish was obtained at the Shioyama fish market during November 1954. Jellied portions having many parasitic cysts were packaged separately in cellophane bags and held in cold storage at -18° C. for 2, 5, 10, 15, and 20 weeks. The parasites of the packaged, jellied swordfish were removed from storage, cut into 10 pieces, and ground in a mortar. Juice from the ground material was pressed through a filter cotton into a small beaker.

(over)

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4 PAGE 1
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

ABSTRACTER: Martin Heerd

HOLDING LIVE LOBSTERS

PREVENTION OF JELLIED SWORDFISH

Eviscerated trout are run down a small metal chute to the head of the dressing bins, where there is a second grading according to size. The fish then are placed into other drops, or slots. Each chute holds a different size and empties into a different case. Trout then are trayed into different-size, institutional, metal freezing molds. The trays are loaded onto carts and rolled to the sharp-freezer, of which the temperature is -50° F. Fresh frozen trout are out of water only 30 minutes.

After they are frozen, the trout are carted to the pulling room, where they are glazed with three coats of ice for additional protection. After they are glazed, the trout are placed in Cryovac bags, vacuumized, and sealed. The trout then move through the shrink tunnel. Rapid movement of the trout through the shrink tunnel does not permit the melting of the ice glaze on the trout. The bags are shrunk to be form fitting. The trout then are put into master cartons and are carted to the storage room, which has a capacity of 125,000 pounds.

Transportation is mostly by Railway Express. Each individual shipment is a freezer in itself. The company figures 5 pounds of dry ice per shipping case of trout per day enroute. A shipment to New York takes 5 days and requires 25 pounds of dry ice per case.

An interesting development taking place is the quiet and almost imperceptible shift to boneless and breaded trout. Although production of the delicious, highly-prized, much-sought-after, boneless and breaded trout began quite recently, it is now 10 percent of total volume.

The marine bacterium respires preferentially on some component(s) of casamino-acids. Casamino acids were oxidized rapidly, whereas galactose and glucose were oxidized at a very low rate. It was not possible to replace casamino-acids with asparagine, glutamate, or glycine. Asparagine, citrate, and glycerol reduced endogenous respiration.

While investigation was in progress, Tomlinson and MacLeod (1957) reported that the inorganic ion requirements for growth of a marine bacterium were also necessary for its oxidation of exogenous substrates. This provides further evidence that the growth requirements used for defining marine bacteria as a group are reflected in their respiratory characteristics, and that true marine forms might be distinguished by manometric as well as by growth studies.

Table 1. --Oxygen uptake by a marine bacterium and *E. coli* in sea water and phosphate buffer.

Suspending Medium	Substrate	ml oxygen consumed in 1 hr. at 28° C.	
		Marine bacterium* (A-11-351)	<i>E. coli</i> ** (Strain B)
Sea water†	-	48.0	13.0
Buffer††	-	11.7	23.5
Sea water	+	212.4	124.0
Buffer	+	83.5	201.3

* 3×10^{10} cells of a 24-hr. culture were added per flask, and 0.17 percent casamino-acids as substrate.

** 2.7×10^9 cells of a 24-hr. culture were added per flask and 0.03 M glucose added as substrate.

† Fresh sea water collected in the vicinity of Fort Johnson and passed through a millipore filter before use, pH 8.1.

†† M/15 phosphate buffer, pH 8.0.

This muscle juice was spotted onto glass slides and dried at room temperature. The dried juice residues were stained with thionine-blue after which they were fixed in the usual manner. Chloromyxum parasites in the juice were counted directly under the 100-power lens of a microscope and expressed in tabular form below as the average number found per 0.01 ml. of juice.

Results. --The Chloromyxum parasites in swordfish decreased gradually but irregularly during cold storage. Collapsed cysts of the Chloromyxum parasite, however, increased slowly during the time that the swordfish was in cold storage. The increase in the number of collapsed cysts may be due to (1) a hindrance of the living function of the cyst by freezing and (2) a mechanical disintegration owing to the growth of ice crystals. It appears, therefore, that Chloromyxum parasites in swordfish meat are susceptible to low temperature and that most will perish with storage of the meat at -18° C. Some of the parasites can survive 10 months of storage at -18° C., and these will resume growth after the meat has been thawed. Freezing and cold storage, therefore, are effective for reducing and hindering the spread of the parasites but not for a complete prevention of the jelling of swordfish meat. The authors recommend the freezing and cold storage of swordfish meat immediately after catching: (1) to retain swordfish meat freshness and (2) to retard the development of jelled meat.

Table 1. --Numerical decrease of Chloromyxum in the jelled meat of swordfish during cold storage.

Time in weeks	2	5	9	11	15
Number of Chloromyxum per 0.01 ml. of muscle juice	1445	783	702	315	292
	1366	702	698	287	291
	1243	580	677	278	294
	1219	578	578	240	233
	1108	547	567	227	233
Average	1276	640	644	269	265

gallons of artificial sea water at 34° F., 43° F., 57° F., and 68° F. without any change in the water or any provision for filtering. The water in those holding tanks, however, was well aerated to provide an ample supply of dissolved oxygen. At the temperatures listed above, the lobsters lived, respectively, 26 days, 19 days, 10 days, and 6 days. These findings indicate that the lower the temperature of the water the longer it will remain suitable as an environment for live lobsters.

Effect of crowding. --Twenty lobsters weighing a total of 20 pounds were held in five different quantities of unfertilized, well aerated, artificial sea water ranging in amount from 10 to 80 gallons at 40° F. These holding conditions were such that if there was available 1 gallon of water for each 4, 3, 1, 1, and 2 pounds of lobster, the lobsters lived, respectively, an average of 73, 53, 33, 22, and 16 days. Lobsters lived more than 4 times as long under the least crowded conditions than they lived under the most crowded conditions.

Practical considerations. --Lobsters will live in water having a fairly wide range of water temperatures, but 40° to 45° is the best water temperature for most holding purposes. This study showed that lobsters could be subjected to varying degrees of crowding. Before the individual operator decides upon a tank size, he must consider the available space, cost and appearance of the holding tank, and the time involved in changing the water. Fresh shipments of lobsters for stocking tanks should be examined carefully on arrival, and any injured or weakened lobsters should be processed quickly before they die.

From experiments of the type reported here, it has been found that vigorous lobsters held at 40° F. in unfertilized artificial sea water will show no serious losses from death if the water is changed every 10 days when there is 2 pounds of lobster per gallon of water, every 14 days when there is 1 1/2 pounds of lobster per gallon of water, every 21 days when there is 1 pound of lobster per gallon of water, every 35 days when there is 3/4 pound of lobster per gallon of water, and every 42 days when there is 1/2 pound of lobster per gallon of water. If lobsters have become weakened because of toxic waste products, they usually will revive quickly when the water is changed.

Behre, A.
Fette, Sellen, Ansrichmittel 56, p. 416 (June 1956) (Hamburg, W. Germany)
World Fisheries Abstracts 8, 25-26 (July-August 1957)

The value of fish is generally estimated from the degree of loss of quality caused by microorganisms. Of the various microorganisms of interest to the fishing industry, the following groups are surveyed and their main properties are tabulated: (i) Non-pathogenic microorganisms. (ii) Parasitic streptococci and staphylococci. (iii) Among the pathogenic bacteria, the spore forming *Bacillus botulinus* is the most dangerous as at least 4 min. of heating at 120°C (248°F.) is needed to kill the spores. Many types of typhoid and paratyphoid bacteria are brought to the fish by insufficiently pure water and may cause illness. The enteritis bacteria (e.g. *Bacterium Gartneri*) belong to the same group. These organisms can continue to live in fresh-water fish kept alive after having been contaminated. (iv) Molds and yeasts are present mainly in smoked fish and may multiply on insufficiently smoked fish; they may also be found in oils and in marinades (mostly from spices). (v) The role of enzymes, e.g., in rigor mortis and autolysis and the possible role of (vi) viruses are mentioned. The extremely heavy contamination of the raw fish during hauling and gutting aboard should be minimized. Even when an uninterrupted cold chain is available from the landing place to the site of retail distribution, there is always an interruption of some 8 to 13 hours in the cold chain while preparing for further shipment, during which interval an undesired multiplication of microorganisms on the fish takes place.

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4, PAGE 3
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

ABSTRACTER: C. J. van den Broek

2. 01 EFFECTS OF TEMPERATURE UPON THE STORAGE LIFE OF FRESH, SHUCKED PACIFIC OYSTERS (*OSTREA GIGAS*)

Liebman, Harmon L.; Kudo, George; Chapel, Julia G.; and Stern, Joseph A. (School of Fisheries, University of Washington, Seattle)
Commercial Fisheries Review 19, 1-4 (December 1957)

Two important factors in considering the storage of fresh, shucked oysters are (1) the speed of cooling after being shucked and (2) the temperature of storage. The best initial means of avoiding bacterial spoilage and the associated dangers are prevention of contamination of growing areas and careful sanitation during processing. Adequate refrigeration is necessary in order to keep bacterial growth at a minimum.

This paper is concerned with the effect of refrigeration practices on bacterial growth and spoilage during cooling and storage. "Total" bacterial counts and pH measurements were employed to follow the spoilage of shucked oysters stored at various temperatures.

Experimental procedure. -- Samples of Pacific oysters were obtained from the Sanish Bay area of Puget Sound. These oysters had been held for two days in the shell. Immediately after the oysters were shucked, they were packed into half-pint friction-lidded glass jars, and jars were then packed into groups and stored in ice at 34° to 38°F., at 39° to 46°F., at 46° to 54°F., and at 48° to 54°F. (The latter temperatures were obtained by placing the jars in a refrigerator, at 33°F., 36°F., 46°F., and 53°F. respectively.) Control samples were taken immediately upon receipt at the laboratory, and the initial pH and bacterial counts were determined. Over the next 16 days, samples were removed from storage at specific intervals, the pH of each sample was measured, and the bacterial counts were determined.

On the day following delivery of the samples to the laboratory, a portion of the jars from the group held in ice were removed from storage. These jars were warmed to a center temperature of

(over)

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4, PAGE 3
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

ABSTRACTER: Kathryn L. Osterhaug

BACTERIOLOGY OF FISH HOLDING FRESH OYSTERS

REPORT FROM THE HAMBURG FISHING GEAR CONGRESS-- TODAY'S TRENDS IN TRAWLING

Alverson, Dayton L. (Washington State Department of Fisheries, Seattle)
Pacific Fisherman 56, 21, 23, 25 (January 1958)

Among the various topics discussed at the recent FAO fishing gear congress held at Hamburg was the subject of trawl fisheries. A number of papers were presented on various aspects of trawling such as new vessel design, factory ships, trawl kites, and midwater trawling.

Deep sea trawlers fishing out of northern European ports are larger than most United States fishing vessels, ranging from 130 to 220 feet in length. Recently a number of large stern-set trawlers have been put into operation in England, West Germany, and Russia. These vessels are equipped with processing plants, which are used to prepare and freeze the catch, extract fish oils, and reduce the remainder into fish meal. Although some of the operational problems still remain, the stern-trawler has proved successful, and more are being built.

In the northern waters of the Barents Sea, White Sea, and other areas, Russian trawlers are giving increasing competition to other European nations. Numbering 1800 vessels, the Russian deep-sea trawl fleet apparently still is expanding and includes 24 of the new stern-set type vessels.

Motherhip operations are used by the Russians and by the Japanese trawling in the Bering Sea. One of the main problems facing motherhips, that of transferring the catch from the fishing vessel in rough weather, has been solved by a system whereby the cod end of the trawl is disconnected and hauled aboard the motherhip with the catch intact.

Two new types of trawl kites designed to increase vertical net opening were described at the (over)

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4, PAGE 3
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

ABSTRACTER: Donald E. Powell

2. 1478 AN EXPERIMENTAL MECHANICAL SHELLFISH-DIGGER

Dickie, L. M. and MacPhail, J. S. (Biological Station, St. Andrews, New Brunswick, Canada)
Fisheries Research Board of Canada, Progress Reports of the Atlantic Coast Stations No. 86, pp. 3-8 (September 1957)

If clams are dug with forks, about 60 percent of the marketable size clams can be obtained from a dug-over clam flat. Almost one half of all clams left behind are killed. In eastern Canada, clams require at least six years of growth before they reach market size. If the clam flats are dug over once a year, the digging process alone will reduce the natural sets of small clams to less than 1/50 of their original numbers at the end of six years. A mechanical digger efficient enough for commercial use and not destructive of small clams could increase production substantially.

Mechanical digger. -- A mechanical digger was developed in the United States about 1953 to dig clams from beds that are permanently under 3 to 8 feet of water. The basic design of this early model clam digger was used to build a digger for use over intertidal clam flats in Canada.

Specifications. -- The basic digging equipment consists of a scoop that is forced ahead through the bottom of the sea by the forward motion of the sea bottom ahead of its path. The rear of the scoop is attached to an endless conveyor belt that brings the dug clams to the surface. Water for the water jets is provided by a 250-gallon per minute centrifugal pump equipped with a 3-inch diameter non-collapsible intake hose and a 2½-inch diameter discharge hose that delivers water to the manifold of the digging scoop.

The digging scoop is made of number 12-gauge sheet iron and consists of two sections hinged together so that the leading section travels parallel to the bottom regardless of the depth at which digging

(over)

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4, PAGE 3
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

ABSTRACTER: Martin Heerdt

MECHANICAL SHELLFISH DREDGE TRENDS IN TRAWLING

2. 01 (Cross Reference: 2. 3)

75° F. in 35 minutes and then were placed in cooling baths. One group was cooled in such a manner that the center temperature reached 50° F. at the end of 2½ hours, a second group was cooled to a center temperature of 50° F. in four hours, and a third group was cooled to a center temperature of 50° F. in six hours. At the end of each of these intervals, the pH and total bacterial count of each sample was determined.

Results and discussion.--The data indicate that an increase in time required to cool the oysters, results in an increase of the bacterial counts and a decrease in the pH. This can be interpreted to mean that the longer the time necessary to cool the product at the required 50° F. level, the poorer will be the condition of the product at the start of storage.

From a point of view of public health, these results also are of importance. If microorganisms present in oysters double in number every two or three hours during cooling from 75° F. to 50° F., and if any of the microorganisms are of fecal origin, then a delay in cooling will result in sufficient numbers of pathogenic organisms to cause the oysters to become dangerous to the consumer.

The results of the 8-day storage study show that the oysters, when cooled to 50° F., would have been classified as "rejectable," using the United States Public Health Service standards, at the end of 4 days of storage. At 65° F., the samples would have been classified as "rejectable" at the end of 4 days. Those stored at 38° F. would have been classified as "acceptable" after 12 days of storage and "conditional" after 13 days of storage. The samples stored on ice would have been classified as "acceptable" through 15 days of storage and "conditional" on the sixteenth day.

It is apparent that temperature is an important factor with respect to the rate of spoilage of fresh-shucked oysters. Rapid cooling and lower temperatures (in the neighborhood of 32° F.) will prolong the storage life, whereas slow cooling and higher storage temperatures are conducive to rapid spoilage and a short shelf life.

0. 5

2. 1478

takes place. Adjustable 8-inch wide shoes bolted to both sides of the scoop ride on the surface of the sea bottom and determine the depth at which the scoop will dig. A conveyor built from 1-1/8-inch hardwood, is attached to the rear of the scoop. This conveyor is 18 feet long, 21 inches wide, and 24 inches deep at the scoop end and tapers to 10 inches deep midway along the frame. The conveyor frame is supported with strips of angle iron along its inner surface and strapped at the ends and at the center with three rectangular sections of 1/8-inch thick angle iron. Two types of conveyor belts were provided for experimental use. Type 1, is a 3/8-inch-mesh woven-wire belt, 18 inches wide and rotated on two 8-inch-diameter rollers set 15 feet apart in the conveyor frame. Type 2, is a 1-inch-mesh flat wire belt driven by two 8-inch sprockets mounted on the drive shaft of the assembly, so that the teeth of sprockets engage directly with the mesh of the belt.

The scoop is towed from the shoes by a chain bridle fastened to a towing warp that passes forward through a ring on the stem of the boat at the water line and then back and up to a cleat on the port washboard. Two booms on a mast that is stepped about amidships suspend the digger by the forward end and after ends over the starboard side of the boat. To put the digger into operation, the entire assembly is swung over the starboard rail and is suspended parallel to the surface of the water. The forward end of the conveyor with its digging scoop is lowered to the bottom, the pump is started, and the boat is set in motion. Digging is accomplished by the action of the water jets, which are directed downward and backward. Clams, shells, and other light objects are washed into the mouth of the conveyor and picked up. Clams are picked manually from the upper end of the conveyor belt, and the debris is returned to the water.

Operation.--In trial runs the mechanical digger covered 900 to 1620 square feet of clam flat to a depth of 1½ inches in one hour. This is more than five times the area that a man could dig in the same time. Less than 1 percent of the dug clams was broken and a similar low breakage of clams was returned to the bottom. The mechanical digger harvested 80 percent of the small clams and 50 percent of the market-size clams in its path. Large, deeply buried clams may not be washed into the scoop as effectively as the shallow, smaller ones.

2. 1121

Conference. A new trawl cable-meter, designed to handle wire from 1/4-inch to 1-inch diameter with splices, was displayed at the meeting.

While visiting European fishing fleets, the author saw a number of the trawlers of some English firms, inflating covered life rafts, which are now required equipment on the trawlers of some English firms.

Midwater trawling has thus far been mainly used for herring-like fishes and cod, but experimentation is going ahead in other fisheries. Both one-boat and two-boat trawls were described, including the Larsen atomic trawl, Icelandic trawl, and the more recent British Columbia midwater trawl for herring. This type of gear is still in a state of evolution, and no one net seems to be best for all types of fish.

0. 7 THE RELATIVE MERITS OF ANIMAL AND PLANT PROTEINS Hubl, E. C. (Oregon State College, Corvallis) Food and Nutrition News <u>29</u>, 1, 4 (November 1957)	The classical studies of Hopkins and of Osborne and Mendel indicated that the nutritional uniqueness of proteins resides in their amino acid content and that the amino acids are utilized in the synthesis of living tissue. For an understanding of the role of protein in the diet, the student must first understand the amino acids. Amino acids.--Twenty-two amino acids are recognized today as arising from the breakdown of protein. These amino acids fall into three groups: the essential, the semi-essential and the non-essential. All of the amino acids are required by the animal in its synthesis of protein, but some of them, the non-essential, are synthesized by the animal at a rate fast enough to supply its needs. The essential amino acids must be supplied from an outside source, as the synthesis is lacking or is so limited that it is unable to supply the needs. A biologically complete protein is one that contains all of the essential amino acids in the right combination. A biologically incomplete protein is one deficient in one or more of these amino acids. This deficiency may be partial or complete. One major difference between animal proteins and plant proteins is in their amino acid composition. The animal proteins provide more of all of the essential amino acids, whereas plant proteins are deficient in some of these. The nutritive value of a protein is based on the availability of its amino acids to the animal ingesting the food. Incomplete liberation or absorption of the essential amino acids will alter the biological value of that protein. One of the factors that can alter the liberation of amino acids during the digestive process is the amount of roughage in the diet. In the plant tissue, the amount of roughage lowers the digestibility of the protein when it is ingested in its native state. Heat also may influence the digestibility of protein. For animal proteins, the application of moderate heat does not (over)	COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4, PAGE 5 UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE 2, 15 NEW VESSEL FISH-ICING TECHNIQUES PROVE VALUE TO NEW ENGLAND FISHERIES Anonymous Commercial Fisheries Review <u>19</u>, 8 (November 1957) A new fish-icing plan aboard vessels is proving its worth to the New England groundfish industry by getting fresher fish on the consumer's dining table. A series of full-scale, commercial demonstrations aboard fishing vessels at sea is being given by the Massachusetts Division of Marine Fisheries and is sponsored by the Bureau of Commercial Fisheries with funds supplied through the Saltonstall-Kennedy Act of 1954 for improvement of the domestic fishing industry. Full loads of fish iced according to techniques developed by the Bureau of Commercial Fisheries are compared with loads iced by conventional methods. The new method relegates to "Davy Jones" many of the practices that have been followed for years. In some instances, it has been difficult for boat owners to initiate changes, but the pressure of economic beginning to outweigh the force of tradition. The new icing practices are a long step toward answering public demand for a uniformly better product. Bureau of Commercial Fisheries' research has shown that the process of getting full-flavored fish to the family table begins at the time the fish are taken out of the water--and that mistakes made in that first hour cannot be rectified later. The new technique is simple. Fish are eviscerated and each fish is thoroughly washed immediately after being caught; each individual fish is surrounded by sufficient ice to chill it rapidly and to (over) COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4, PAGE 5 UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE ABSTRACTER: Kathryn L. Osterhaug A COMPARISON OF PROTEINS FISH-ICING TECHNIQUES
--	---	--

2, 3 MEAT CONTENT OF PAVLOF BAY KING CRABS Sakuda, Henry M. (U. S. Fish and Wildlife Service, Pacific Salmon Investigations, Seattle, Washington) Commercial Fisheries Review <u>19</u>, 4-5 (November 1957)	Previous data on the meat content of king crabs (Paralithodes camtschatica) are based on production figures, and do not include the size of crabs from which the yields were obtained. The present study was undertaken to determine the meat content of various commercial-size king crabs. In order to simplify future estimates of meat content a relationship between the meat of some part of the crab and the entire meat yield was desired. With such a relationship established, it would be necessary only to take and weigh meat from this body part to estimate the total available meat of the whole crab. The merus (thigh) section of the right third leg was selected for this purpose. Specimens were selected to include all the commercial sizes of king crab present. In an effort to keep the method of weighing constant, weights were taken immediately upon removal of crabs from the live tanks and subsequently upon removal of the cooked crabs from the cooling tanks containing running sea water. Prior to meat extraction, the carapace and gills were removed, and the body was broken in half and rinsed. The leg meat was extracted by a pressurized jet of water forced into the outer extremity of the propodus. After the initial force of water had removed most of the meat, bits of meat often were found adhering to the tendons. These were recovered by breaking the shell at each joint. The extracted meat was washed by sprinkling with water. (over) COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4, PAGE 5 UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE ABSTRACTER: Kathryn L. Osterhaug	2, 3 WATER TREATMENT IN FOOD FACTORIES Anonymous Food Manufacture <u>32</u>, 552-554, 558 (December 1957) This paper describes the three principal ways in which water from a private source of supply may be treated before being used in a fish processing plant. Clarification.--When water is drawn from rivers or other surface sources, periods of time may occur during which the water will be very turbid, and in some instances actually muddy. Under these circumstances, a process of flocculation and sedimentation may be required to remove the sediment. Sedimentation is usually carried out in a large tank or in a series of large tanks. Each tank is baffled to prevent a direct flow of the water between the inlet and outlet and to reduce turbulence to a minimum. A coagulant, such as ammonium sulphate or iron alum, is usually added to the water at the inlets to flocculate the suspended material and to increase the rate of sedimentation. Lime also may be added if the carbonate content of the water is too low to precipitate the aluminum by-product formed by the addition of a coagulant. With the addition of ammonium sulphate or iron alum, usually at a level of 1 grain per gallon of water, the suspended material settles out as the water passes over and around the baffle walls of the tank. Clear water then can be obtained from the top of the tank, whereas the accumulated sediment must be removed periodically from the bottom of the tank. Filtration.--After the gross sediment has been removed by sedimentation or with waters that do not require sedimentation, the second stage in water treatment is filtration. In large-scale water-treatment plants, sand beds are made of coarse filter material and are preceded by a rough filter, though sand beds are usually used in more than three feet of heat pressure. For factors such as the pressure and filter is more usual. This device is a simple mechanical filter capable of handling as much as 100 gallons of water per square foot of surface per hour. Pressure sand filters usually are equipped (over) COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4, PAGE 5 UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE ABSTRACTER: Martin Heerdt MEAT CONTENT OF KING CRAB WATER TREATMENT
---	--	---

2.15

keep it chilled. The secret of the success in handling fish by the new method is in the way that the fish are stored and iced.

Through the cooperation of the industry, a man trained in the Bureau's new method goes aboard fishing vessels and demonstrates the handling and icing of the fish. In port, under the supervision of State inspectors, the results of the improved method can be compared with results from conventional means. The entire load of fish from one such demonstration-cruise recently was adjudged "the best fish seen in this port for a long time."

0.7

cause changes of nutritive importance. However, the application of excessive heat or heating in the presence of carbon dioxide in the individual food may cause serious losses in nutritive value.

Utilization of these losses may be due to one or all of the following changes that can occur in the food: (1) loss of amino acids, (2) the formation of complexes which retard the action of digestive processes making the amino acids unavailable for protein synthesis, and (3) the alteration of the protein molecule in such a manner that the rate of release of the amino acids during digestion will be retarded.

The nutritive value of proteins is affected by the optimum utilization of the amino acids present in the blood stream. It has been shown by animal feeding experiments, that tissue synthesis occurs only when all the required amino acids are supplied simultaneously. An interval of greater than one hour between the ingestion of the incomplete protein or amino acid mixture and the ingestion of the completing protein or amino acid leads to a failure of either to be utilized. This was demonstrated by Geiger and co-workers who fed a mixture of 9 essential amino acids and after a lapse of time fed the 10th essential amino acid. Harte, Travers, and Sarich have shown that rats grew poorly when they received alternate feedings of wheat gluten and milk protein, but grew rapidly when these proteins were mixed together. These results indicate that not only do all the essential amino acids have to be present but they must also be present in suitable concentrations for effective utilization. From the standpoint of amino acid content, utilization, and digestibility, most animal protein food are of superior value.

The supplementation of essential nutrients that are absent or lost during the processing of food-stuffs can be achieved in the following ways: (1) by the use of food combinations whose amino acid proportions augment each other with a more even distribution of high quality protein and (2) by the use of crystalline amino acid supplements to achieve correct metabolic proportions. An experimental approach should be used to prove the value of the supplementation.

2.3

with a sand bed that is put in place before use and remains in place permanently. Pressure-type sand filters are cleaned by compressed air and by backwashing with water. The formation of a layer of biological material growing on the surface of the filter aids in the proper functioning of the filter.

If water with an extra degree of sparkle is required, a polished filter that contains diatomaceous earth supported on screens of non-corrosive material must be used. These filters are primed with diatomaceous earth, and the emergent water is recirculated until it is crystal clear. Additional diatomaceous earth continuously is added as a slurry with a small amount of the incoming water so that the filter bed remains perpetually open in structure. This method gives a very rapid rate of filtration; therefore it is becoming increasingly popular not only as an adjunct to sand filtering but, in some instances, as an alternative to sand filtration.

Chemical sterilization of water.-- Efficient filtration usually removes up to 90 percent of all bacteria; however, if the initial quality of the water is poor it may require further purification. Even clear water may be contaminated with bacteria. In these instances, it is customary to provide chemical sterilization with chlorine. Chlorine usually is added in the form of dissolved chlorine gas from some form of proportioning device. Before free chlorine can be made available in the water for sterilization purposes, sufficient chlorine must be added to compensate for the chlorine that is being used up in reactions with the organic matter in the water. The amount of residual chlorine required also depends on the time of exposure of the water to the chlorine before use and on the purpose for which the water is intended. A residual chlorine of content 0.5 parts per million (p.p.m.) with a contact time of 15 minutes usually will kill all pathological bacteria but not necessarily all food spoilage organisms. In canneries, the water used to cool the cans after heat processing, therefore, should receive sufficient chlorine to free it from spoilage organisms. This usually requires a residual chlorine level of about 2 p.p.m. Super chlorination of this type followed by dechlorination with sulphur dioxide or active carbon is a highly efficient method of removing bacterial or algal tastes and is of assistance in the removal of iron and manganese from water.

2.3

The meat from the right third merus and the total meat from each specimen were weighed. Results.--Twenty specimens were collected between April 20 and April 26, 1957. The mean meat weight is 27.48 percent of the live weight. The merus meat averages 2.23 percent of the live weight, 2.33 percent of the cooked weight, and 8.11 percent of the total meat weight.

There was a decrease of 4 percent in the mean live weight of the specimens after cooking.

Summary.--(1) There was a slight decrease in weights after the specimens were cooked. (2) The live weights and total meat weights did not increase proportionately. (3) A higher percentage of meat yield was recovered from the smaller specimens. (4) The percentage of merus meat weight to total meat weight remained fairly constant throughout the sizes. (5) Indications of a constant ratio between the merus meat weight and the live weight enable the use of the merus meat as a suitable standard for future estimates of meat content.

Lindner, Milton J.

Special Scientific Report: Fisheries No. 235, 166 pp. (November 1957) (U. S. Fish and Wildlife Service, Washington 25, D. C.)

This report is primarily an examination of the potentialities of the shrimp fisheries of Latin America as a source of supply for the United States market.

A survey conducted by the author indicates that there are vast stretches of coast along continental Latin America where the shrimp populations are very sparse or are concentrated in patches in widely scattered areas. For some countries the production outlook is favorable and the prospect for the development of the fishery is discussed in relation to the availability of commercial species on the fishing grounds, processing and marketing costs, and the effect of government regulations and controls. In the case of Mexico, the chief source of shrimp imports into the United States, the fishery appears to have reached the stage where productive ability no longer depends upon fishing or plant capacity but more upon the biological potential of the species of shrimp and the capacity of the market to absorb smaller-sized shrimp.

There are at least 21 species of marine and brackish-water shrimp that are of commercial importance in continental Latin America. However, 10 species of shrimp belonging to the genus *Penaeus* comprise the bulk of the shrimp fishery, accounting for about 90 percent of the total catch.

ABSTRACTER: Milton J. Lindner

2. 8 RESEARCH ON ELECTRONIC COOKING

Fenton, Faith (New York State College of Home Economics, Cornell University, Ithaca)
Journal of Home Economics 49, 709-716 (November 1957)

In electronic ovens a magnetron tube, or generator, is used to change electricity into microwave. The tube emits energy that is beamed into the food, where it produces heat. The oven is equipped with proper controls, which include a rotating fan to distribute the waves and thus insure more uniform cooking.

Reflection. -- Metals act as reflectors of microwaves. Metal containers are not recommended because they shield the food and may result in electric arcing. Oven racks are made of fiber glass. Special thermometers are used in electronic ovens.

Transmission. -- Air, and most containers made of chinaware, glassware, plastics, and paper transmit the energy, and are not heated.

Absorption. -- Foods absorb the waves, which cause agitation of the molecules and friction, which in turn results in heating of the food.

Penetration. -- Microwaves have the property of penetrating food from 2½ to 3 inches. In electronic cooking, the waves penetrate toward the center of the food, and are absorbed as they go along.

Speed. -- Electronic ovens can be turned to high or low speed. Cooking times are from one-half to one tenth those required by conventional methods. A cooking table is given. The method is safe. Although foods do not burn in the electronic oven, they may be overcooked, become mushy, and dry out. Some foods need to be turned to obtain uniform cooking. If a moist surface is desired, the food should be covered.

The most amazing differences between electronic cooking and conventional cooking are the great

(over)

ABSTRACTER: June H. Olden

SOUTH AMERICAN SHRIMP

ELECTRONIC COOKING

Duncan, D. W.; Leung, J.; LePage, N. A. W.; Boyd, J. W.; and Tarr, H. L. A. (Fishery Technological Station, Vancouver, B. C., Canada)
Fisheries Research Board of Canada, Progress Reports of the Pacific Coast Stations No. 109, 14-15 (November 1957)

Experimental. -- The effectiveness of tetracycline antibiotics for whale preservation has been the subject of further study during 1957. Hollow lance applications were made by injecting a 3½ ounce portion of chlortetracycline hydrochloride (CTC) dissolved in 30 gallons of sea water into the visceral cavity of each harpooned whale as soon as practicable. Bombhead applications were made by killing whales with harpoons that contained 50-gram portions of either CTC or oxytetracycline hydrochloride (OTC) packed into a polyethylene bag and inserted into the nose of the bombhead or the harpoon beneath the black powder. About 60 percent of all harpoons fired but did not whaling. The total number of bacteria present in samples of excised meat from the whale was determined. The station on shore showed a wide variation in counts and indicated difficulty in obtaining distribution of the antibiotic in large numbers of species.

Results. -- During 1956, bacteriological counts in samples of excised meat from whales that were injected with CTC were much lower during the first 20 to 25 hours after death than were bacterial counts in samples of excised meat from untreated whales. These findings were specific for the deep meat near the backbone, the meat from the throat region, the deep meat from the abdominal side, the surface meat near the blubber, the liver tip, the center of the liver, and the area of the liver between the tip and the center of the liver. CTC or OTC applied by the harpoon bombhead method in 1957, appeared to be less effective than CTC or OTC applied by injection in 1956.

(over)

ABSTRACTER: Martin Heerdt

3. 12 EVALUATION OF CLORPACTIN WCS-50 AS A BACTERICIDAL WASH
FOR CRAB AND OYSTER MEATSBenarde, Melvin A. (Seafood Processing Laboratory, University of Maryland, Crisfield)
Applied Microbiology 5, 137-140 (May 1957)

In order to extend the edible life of fresh shellfish, the bacterial contamination must be sufficiently low to prevent their metabolic products from subverting these foods before they are consumed. Shellfish receive a considerable amount of handling during their preparation for market, which can debase an otherwise sound product. A supplementary protective rinse before they are packaged might reduce the bacterial load. Only a small number of chemical germicides are legally available at present.

Several recent publications in clinical journals have reported that Clorpactin WCS-50 approaches the "ideal germicide." The report of its nontoxic, nonirritating characteristics prompted the writer to evaluate this agent for possible application to crab and oyster meats--two items known for extremely rapid bacterial deterioration.

Experimental. -- For tests with crabmeat, Clorpactin WCS-50 (food grade), a fairly free-flowing, water-soluble, white powder, was added to tap water. To prepare concentrations of 0.14, 0.26, and 0.56 percent, respectively, 1.4, 2.6, and 5.6 grams were added to 1-liter quantities of water. For the tests with oyster meat, only 0.26 percent Clorpactin was used. The oysters, however, were subjected to a much longer contact with the bath. A packed count of the bacterial contamination of the crab (*Callinectes sapidus* Rathbun) was obtained from commercial crab houses and at our laboratory. From results of the initial plate counts on the untreated samples, the commercial samples were arbitrarily designated "high" and "moderate" count and the laboratory samples were designated "low" count. Seventy-five-gram samples of the meat were placed on 14 by 14 inch squares of cheesecloth, which were then folded to prevent the meat from escaping into the treatment bath.

(over)

ABSTRACTER: Kathryn L. Osterhaug

ANTIBIOTICS FOR WHALE PRESERVATION

PRESERVATIVE FOR SHELLFISH

speed of cooking and the coolness of the containers and of the oven air. The greatest difference in results is the limited amount of browning and crusting of surfaces in electronic cooking. When browning units--a part of home electronic ovens but not of the institutional oven--are turned on, they do not detract from the chief characteristic of speed, but they do eliminate the cool container and the cool oven air. Electronic ovens are not intended for cooking large quantities of food in the oven at one time.

Studies of current literature on the nutritive value retention and palatability of foods cooked electronically have been made with the institution-type oven. They have included comparisons of one or more conventional methods with electronic cooking. Reports have been made on (1) blanching of vegetables prior to freezing; (2) cooking of fresh vegetables, frozen vegetables, roast meat, ground meat patties, and baked goods; and (3) reheating of frozen precooked meat dishes and vegetables.

The nutrients studied include ascorbic acid, thiamine, riboflavin, niacin, and amino acids. These studies indicate that as much, or more, of these nutrients are retained in electronic blanching, cooking, or reheating as in conventional methods.

Some foods were scored as high, or higher, in palatability when cooked electronically as when cooked conventionally. There was no consistent trend in favor of either method of cooking for all quality factors of any one food. Surface appearance was the quality most often scored lower in electronic cooking. In the very important quality of flavor, the electronic-cooked product was usually scored as high or higher, except in those products in which we have come to expect a "browned" flavor.

Moisture content may be as high in one method as in another, if no overcooking occurs. Electronic cooking of meat usually results in more cooking drip.

Studies are needed on the retention of nutritive value and palatability in the new home electronic ovens with and without the use of the browning units. Further studies needed include techniques for obtaining maximum palatability in roasts, less tender cuts, angel cakes, and yeast bread.

Although each home electronic oven is now equipped with directions for cooking, including cooking times, each owner of a microwave oven will need to learn from experience how best to use her oven to produce the best products and to make it function most efficiently in her particular setup.

The meat-filled cloths were placed into 1-liter quantities of the Cloropactin solutions for periods of up to 30 minutes. During this time, they were continually agitated in order to facilitate dispersion of the Cloropactin throughout the meat particles. At the end of each test period, bacterial plate counts were made.

Samples of oysters (*Crassostrea virginica*) shucked in their own liquor were obtained from commercial oyster houses. Sufficient Cloropactin WCS-50 to achieve the desired concentration was added directly to a liter of oysters; additional water was not added. A liter of tap water (30 to 35°C.) was added to a similar group of shucked oysters, and this was made up to concentration with Cloropactin. Both groups were agitated continually in an attempt to insure adequate contact between the oyster meat and the Cloropactin. At each test period, plate counts were carried out as for crabs.

Results and discussion.--A 0.28 percent Cloropactin solution was used as a control. A tercidol to reduce the contamination of crabmeat to levels permitable by law. Plate counts of approximately one hundred thousand organisms per gram were obtained. A 0.28 percent Cloropactin solution was used. Its total reduction of crabmeat was 9.6 percent in 2 minutes, or approximately 99 percent of its total reduction. "Moderate" count meat obtained a 58 percent reduction in the initial 2 minutes, or 78 percent of its total reduction. With "low" count meat, 70 percent of the reduction was obtained in the initial 2 minutes of contact.

Reduction patterns of similar nature were observed with the tap-water controls. Although distinct reductions were obtained by simple washing, the superiority of Cloropactin was evident. Because of the heavy chlorine-like odor evolved in the treatment bath, additional concentrations of Cloropactin were not studied until organoleptic evaluations of the 0.28 percent treated meat were completed. After 2 days, the "high" count product was putrid. After 5 days, both the "moderate" and the "low" count meat was found to smell heavily of laundry bleach and to have a bitter taste. No more testing was performed with crabmeat because the chlorine-like odor would preclude its sale.

Before proceeding with a study of Cloropactin-treated oyster meats, samples were immersed in a 0.28 percent solution to determine the influence on odor and taste. As no untoward odors or tastes were discernible after the 12-hour storage period, the oyster meats were subjected to Cloropactin treatment at three concentrations. Substantial reductions in the bacterial populations of shucked oyster meats were obtained by a concentration of 0.56 percent.

Comparatively few whales were harpooned, and not enough data were obtained. The bombhead method does not appear to offer much promise for preserving whale carcasses from bacterial spoilage.

Table 2.--Millions of bacteria per gram of whale tissue, 1957 season.

Post-mortem age (hours)	No. of whales examined	Tissue*					
		A	B	C	D	E	F
From untreated carcasses	18	0.24	0.31	9.2	12	12	92
21 - 25	10	38	31	73	130	120	190
26 - 30	12	18	7.4	150	110	190	140
36 - 40	3	40	19	390	360	150	570
41 - 50	5	260	250	150	800	710	--
From carcasses treated with OTC introduced by the harpoon							
21 - 25	3	0.82	0	0.98	0	0.75	15
26 - 30	5	0.12	1.6	26	9.3	1.8	460
36 - 40	4	0.34	0.14	35	3.3	1.1	310
41 - 50	3	19	2.0	350	120	2.2	590
From carcasses treated with CTC introduced by the harpoon							
21 - 25	3	0	0	0.038	0.075	0.038	1.8
26 - 30	2	1.1	0.33	15	0.68	1.0	0.22
41 - 50	8	77	31	280	680	515	600

* A, front surface muscle close to blubber; B, rear surface muscle close to blubber; C, front deep muscle near backbone; D, rear deep muscle near backbone; E, deep muscle from flank; F, liver tip.

2, 111 PRESERVATION OF FISHING GEAR--NETS

Anonymous
Fiskeri Tidskrift 65, p. 47 (March 1956) (Sodergras, Sweden)
World Fisheries Abstracts 8, 13-14 (July-August 1957)

The following description of cutting and tarring is a result of a series of experiments at the Danish Technological Institute. The procedure must be followed in detail if the result should be satisfactory. The tanning with cutch is done in a boiling solution of 4 to 5 kg. (8.8 to 11 lb.) cutch/100 l. (26.4 gal.) water. The net is boiled in the solution for 1 hr. and thereafter left in the hot solution till next day. It is then removed and thoroughly rinsed till the rinsing water takes no more color. The rinsing can also be done by leaving the net in the sea overnight. The tanned and rinsed net, which may still be wet, is thereafter laid in a boiling fixing bath containing 1/2 kg. (1.1 lb.) CuSO₄ and 1/2 kg. of K₂Cr₂O₇ or Na₂Cr₂O₇/100 l. water. The fire under the kettle is extinguished when the net is in the solution. The net is removed after 1 hr. and rinsed thoroughly. If the fixing solution is to be used over again the same amounts of chemicals must be added anew. A fixing solution should, however, not be used more than 4 to 5 times. Fishing gear not to be tarred can be put into the sea and immediately after fixation. If possible, the fixing solution should be prepared in a copper kettle or tarred from kettle.

Before the tarring process, the net should be dried completely. The first tarring is done with a medium heavy coal-tar, preferably warm and free from impurities. The net is placed in the tar for 1/2 hr., allowed to drain off, and thereafter dried. It is very important that the drying be absolute, and should, if possible, take 4 to 6 weeks. After drying, the nets should be dipped in cold, thin coal-tar before they are put in the sea. Old nets, previously tarred, should likewise be treated with cold thin coal-tar. A net treated in this way will keep at least twice as long in localities where it otherwise

(over)

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4, PAGE 8
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

ABSTRACTER: Birger Rasmussen

3, 19 RADIATION PROCESSING OF FOODS, 2. A COMMENTARY ON PRESENT RESEARCH

Hamman, R. S., and Thornley, Margaret J. (University of Cambridge and Department of Scientific and Industrial Research, England)
Food Manufacture 32, 559-562 (December 1, 1957)

The possible use of ionizing radiations in the pasteurization of several types of foodstuffs are discussed. The most promising is the possibility of inactivating a large proportion of the micro-organisms initially present. Inactivation of 98.9 percent of these organisms, for instance, would extend appreciably the keeping time before the population reached the spoilage level--normally about 10¹⁰ to 10¹² organisms per gram. Since a given dose, in general, inactivates only a given proportion of the organisms, it is obviously important to keep the initial numbers low.

The suggested dosage range for pasteurization is from 50,000 rads to one million rads. Even at the higher dosage suggested, bacterial spores and certain Micrococci are not inactivated. The treated product must, therefore, be handled carefully.

Figure 4 (see over) shows the typical results obtained in work with minced chicken meat. The results with other meats and fish are similar to those with chicken. The radiation odors and flavors are more intense with beef and less intense with pork, but their general character is similar in most muscle tissue.

There is more promise of preventing loss of quality at pasteurizing dose level with some processed meats, such as pork sausages and bacon than with raw meats. This may be accounted for by the presence of "protective compounds" such as sulfites or nitrites in the processed meats. With

(over)

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4, PAGE 8
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

ABSTRACTER: David T. Miyauchi

GEAR PRESERVATION

RADIATION PASTEURIZATION

3, 2341

EXPERIMENTS ON THE FREEZING OF FISH IN AN AIR-BLAST FREEZER

Nagaoka, J.; Takagi, S.; and Holani, S.
Proceedings 9th International Congress of Refrigeration, Paris, 1955, pp. 4105-4110
Food Science Abstracts 29, 421 (October 1957)

Albacore tuna, yellowtail, mackerel, carp, snapper, mackerel pike, tunny, cuttle-fish, and whale meat were frozen experimentally in a cabinet type of air-blast freezer. Plank's equation was used to calculate the rate of heat transfer at the surface of whole fish using measurements of air temperature and time required for freezing. The rate of heat transfer was found to be proportional to the 0.4th power of the equivalent diameter of the fish.

Fish that were located parallel to the stream of air had a rate of heat transfer about 10 percent lower than fish that were placed across the stream of air. Fish that were packed in pans had a rate of heat transfer proportional to the 0.8th power of the velocity of the air. Finned plates that were attached to both sides of the fish during freezing considerably increased the rate of heat transfer.

The belly side of the fish usually froze more slowly than the other parts. Only rarely did the loss of weight due to freezing by conventional methods exceed 1 percent of the original fish weight, the use of air blast for freezing did not increase the loss of weight. Air movement at the rate of 2 to 3 m. per second produced a 10 percent increase in the rate of freezing. In excess of 10 meters per second something was caused in the body of the fish which caused the fish to freeze more slowly, increasing the rate of freezing. Fish frozen in an air-blast freezer had a better flavor than similar fish frozen in still air when they were compared after both had been thawed and cooked.

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4, PAGE 9
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

ABSTRACTER: Martin Heerdt

3, 2341 MODERN FREEZE TUNNELS REALLY BOOST PERFORMANCE

Overbye, M. R. (York Division, Borg-Warner Corporation, Seattle, Washington)
Food Engineering 29, 112-115 (December 1957)

Today's belt freezer-tunnels freeze more food in less space and at less cost than tunnels built within the past 10 years.

Freezer belts. --The most economical belt width is 8 feet; however, 10-foot wide belts are available at premium prices for belt machinery. Variable speed drives of 2 to 8 feet per minute are desirable and speeds of up to 18 feet per minute are available if required. For general purposes, a 17 gauge, 5 mesh, galvanized belt is recommended; however, stainless-steel belts may be advantageous from the standpoint of sanitation and durability provided their cost can be justified. Normal belt loadings range from 1.3 to 1.8 inches in depth. These loading values may vary in practice, particularly when belts are operated at very high speeds.

Air-cycle design. --Air is the most commonly used heat transfer medium; however, it is the most ignored and least understood phase of freezer-tunnel operation. More freezer tunnels are hampered for lack of air capacity because of poor air cycle design than through the lack of refrigeration capacity. Air cycle equipment must have sufficient capacity to keep the entire volume of air in use at 80° F. Air capacity is measured in cubic feet per minute. About 30,000 to 35,000 cubic feet per minute are required per ton of frozen product. About 30,000 to 35,000 cubic feet per minute of air is required per ton of frozen product. The best means of distributing air through a freezing belt is a simple discharge onto a plenum chamber designed for uniform static pressure. This arrangement will bleed air uniformly through the bed without the loss of turbulence or baffles, and will function adequately even with 4-inch depths of peas on the freezer belt. For maximum efficiency, freezer belts must be loaded continuously and uniformly.

Compact axial-flow fans are well suited for air cycling. If installed in sufficient numbers they

(over)

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4, PAGE 9
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

ABSTRACTER: Martin Heerdt

AIR-BLAST FREEZER EXPERIMENTS

MODERN FREEZE-TUNNEL DESIGN

other products, such as vegetables, fruits, and dairy products, there are only limited indications of success in applying "pasteurization" treatments.

For sterilization of food products, doses of 2 to 3 million rads are required to inactivate all microorganisms in small laboratory-scale samples, but it appears that 5 million rads will be required to reduce the possibility of survival of *Clostridium botulinum*. Most foods, however, suffer a marked loss of quality at dosage levels of such high magnitude. This makes their commercial value doubtful unless a method can be found to lessen the undesirable effects of irradiation on quality.

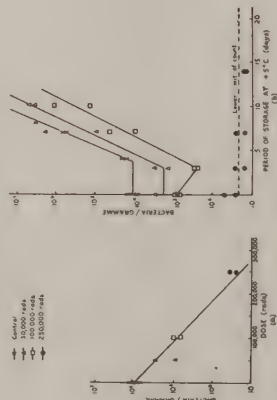


Figure 4. "Pasteurization" of minced chicken meat with 3 MeV cathode rays.

(a) Reduction of the numbers of viable bacteria with increasing doses.
(b) Subsequent increase in numbers during cool storage.

The meat was irradiated in flat aluminum cans 2.5 in. dia. x 0.4 in. deep and was in an anaerobic condition during irradiation and storage.

would rot in a few years. In the tanning and fixing process, the net will shrink about 10 percent. Experiments in the Danish Technology Laboratory tank have shown that tanning by cutch, followed by fixing, has proved superior to other treatments, having a keeping quality of 15 'periods' compared to "periods" up to 3 for other preservatives.

will provide uniform air distribution through the heat exchanger coils as well as in the plenum chamber for nearly the full length of the tunnel. Although air travel through the main tunnel belts may be either up or down, in most cases the air movement is down through the product with air returning to the bottom coils. The temperature of the air coming from the coils should be -10°F . Freezer operation in an 8°F . or lower range requires sufficient air so that the air returning to the coils will be no warmer than -2°F . If this operation is coupled with a -35°F . evaporator temperature, an economical system will result.

Precoolers.--Precooler units are of two types: those that use air as a medium of cooling and those that use water as a means of cooling. Both are designed to drop product temperatures to about 34°F . and to feed the main belt.

Tunnel coils.--The three types of evaporator coils used in freezing tunnels are: bare pipe coils, finned coils, and factory-built air-handling units of either dry-coil or brine-spray coil design. Because of their air-handling limitations, factory built units are not commonly used. Usually, evaporator coils are designed around the defrosting problems of the freezer tunnel and its peculiarities of design. Fin coils are best for freezer-tunnel use because they have a small primary surface as compared to bare pipe coils and a large secondary surface. Finned coils that are fed by a liquid ammonia recirculating system provide high capacity, high efficiency, and rapid defrosting. The simplest part of the freezing problem is probably the selection and balance of the high-speed equipment. To minimize horsepower requirements and for economical design, the use of a 35°F . evaporator temperature is recommended. This temperature provides a balanced system at low initial and operating costs when used with the correct high-capacity coil.

Sanitation.--Today's freezer tunnels should be either concrete or steel floor, preferably with a steel recessed defrosting basin at least under the coils for the full length of the tunnel and with a drain into the sewer. Tunnel insulation of a board form is preferred because it is not damaged by water. Freezer tunnels should be designed for complete access for maintenance as well as for cleaning and proper sanitation.

Melin, G.
Svensk Fiskeri Tidsskrift 66, p. 30 (February 1957) (Sodergr, Sweden)
World Fisheries Abstracts 17-18 (September-October 1957)

In the work of net hanging, certain standard rules should be adhered to. Primarily the corklines and leadlines should be properly balanced, and the hanging of the net on the corkline should assure a satisfactory mesh opening. It has often been a problem to find at what distance the meshes should be hung on the corkline of a gill net in order to obtain the greatest fishing ability. In general, the normal distance between the meshes hung is the same as the length of a mesh bar, or perhaps 5 to 10% shorter. But variations can be found, ranging from 20% decrease to 10% increase of this measurement. The Swedish Fresh Water Laboratory, Drottningholm, Sweden, has carried out experiments in order to get a clear understanding as to which type of hanging would be the best. The gill nets used in the experiment were made of exactly the same mesh size, and all the nets the same number of meshes in length and depth. Two parallel series of tests were run simultaneously, one with gill nets made of spun nylon, and the other of monofilament nylon. Three alternative net hangings were chosen, i.e., narrow, normal and wide mesh opening. In all nets, the mesh bar measured 43 mm. (1.37/16 in.), and they were hung at resp. 34 mm. (1.37/32 in.), 40 mm. (1.37/16 in.), and 46 mm. (1.37/16 in.), between the knots on the corkline. Due to the difference in the hanging, the nets varied in length from 23.8 m. (78 ft.) to 32.2 m. (105.6 ft.).

Experimental fishing was carried out in a number of lakes in Sweden. A total of 85 nets were made. The results of these fishing experiments are given in tables. The experiments proved that hanging No. 2, i.e., the normal hanging gave the best results. Hanging No. 1, the difference in proved to be the least effective and gave the smallest returns. Furthermore, the difference in

(over)

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4, PAGE 11
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

ABSTRACTER: Birger Rasmussen

3. 236 TECHNICAL NOTE NO. 41. --BACTERIAL STUDIES OF FROZEN, RAW, BREADED SHRIMP

Kern, Jerome (Fishery Technological Laboratory, Bureau of Commercial Fisheries, College Park, Maryland)
Commercial Fisheries Review 19, 11-14 (December 1957)

Sales of frozen, raw, and precooked fishery products have increased markedly in the past several years. The development of voluntary grade standards is desirable as an aid in the production and marketing of these products. The U. S. Bureau of Commercial Fisheries is engaged in research designed to collect the information required for the development of such standards for a variety of frozen seafoods. The objective of one project is the investigation of microbiological procedures currently employed for the examination of foods in order to determine their suitability for use on frozen products.

Experimental procedure. --Samples of frozen, raw, breaded shrimp were obtained for bacteriological examination from retail sources as well as directly from several processors of breaded shrimp. In addition, samples of unfrozen raw shrimp, breaded, and batter mixes were collected from the processors, placed in sterile containers, frozen with dry ice, and transported to the laboratory for microbiological analysis.

The samples taken were analyzed for the presence of coliform, enterococci, and staphylococci bacteria.

Results and discussion. --The data collected indicate that a wide range in total numbers of microorganisms existed in the finished product and in the raw component materials. Only one sample of

(over)

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4, PAGE 11
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

ABSTRACTER: Kathryn L. Osterhaug

HANGING FISH NETS

BACTERIOLOGY OF BREADED SHRIMP

3. 239 ON THE FORMATION OF DRIP IN THE FREEZING OF SQUID MEAT

Tanikawa, E.; Akiba, M.; and Kawakami, K.
Proc. 9th Int. Congr. Refrig., Paris, 1955, pp. 4 058-4 065, 4 082-4 095
Food Science Abstracts 29, 429 (October 1957)

The purpose of this study was to investigate (1) the formation of drip in quick-frozen squid (cuttle-fish) muscle and (2) the effect of immersing squid muscle in aqueous solutions, each at a different pH value or in sodium chloride solutions, each at a different concentration.

Experimental. --Free drip was estimated on the basis of (1) the amount of fluid that exuded when frozen fish was allowed to thaw undisturbed and (2) the amount of fluid that was expressed from the thawed fish when it was placed under a pressure of 0.5 kilograms per square centimeter. Also determined were (1) the solubility of cuttle-fish protein in 0.6 Molar sodium chloride solution and (2) the degree of hydration of the protein in frozen cuttle-fish. Volatile basic nitrogen was determined and used as an index of freshness.

Results. --The amount of drip increased with increasing length of frozen storage of the fish. Drip formation appeared to be caused by denaturation of the proteins. This denaturation resulted from dehydration or the condensation of salts; therefore it increased with the duration of storage. Drip formation also appeared to be caused by the liberation of a part of the bound water.

Cuttle-fish flesh decreased in water activity when it was subjected to treatment by which the pH of the flesh protein was changed to either the acid or the alkaline side of the isoelectric point or when the flesh was immersed in sodium chloride solution. The same treatment indirectly increased the affinity of the cuttle-fish flesh protein for water. Similar experiments conducted with Alaska mackerel (over)

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4, PAGE 11
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

ABSTRACTER: Martin Heerd

3. 2490 FROZEN STORAGE OF PLAICE FOR SUBSEQUENT THAWING AND FILLETING

Dyer, W. J.; MacCallum, W. A.; and Fraser, Doris I.
Fisheries Research Board of Canada, Progress Reports of the Atlantic Coast Stations No. 66, pp. 9-12 (September 1957)

Purpose. --Experiments were carried out to learn if frozen plaice could be stored for thawing and filleting at a later date.

Experimental. --Two lots of American plaice that had been iced for seven days aboard the boat and were in fairly good condition were used in this study. Lot 1 consisted of 500 pounds of washed and ungutted plaice, and lot 2 consisted of 500 pounds of washed and gutted plaice. Fifty pound quantities of plaice from each lot were air-blast frozen in pans at -20° F. for one to two hours and placed in storage in wooden boxes at -10° F. and at +10° F. The remaining 400 pounds in lots 1 and 2 were re-iced in large containers. After total icing periods of 11, 14, and 18 days including the time on the vessel, they were removed from the ice, washed, air-blast frozen in pans, boxed, and placed in storage at -10° F. and at +10° F.

Findings. --Before they had been frozen, the ungutted and gutted plaice had a trimethylamine content, respectively, of 1.2 and 1.4 milligrams per 100 grams of plaice. After 11, 14, and 18 days, respectively, the contents were 8.0, 10.0, and 12.0 milligrams, 14 and 16 milligrams, and 52 and 45 milligrams of nitrogen per 100 grams of plaice. Plaice that had been held for 18 days in ice were spoiled and the filets had a greenish tinge.

Samples of frozen plaice were drawn from frozen storage at the end of 1 month and again at the

(over)

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4, PAGE 11
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

ABSTRACTER: Martin Heerd

DRIP FORMATION IN SQUID MEAT

FROZEN STORAGE OF PLAICE

3. 236 (Cross Reference: 8. 8)

unfrozen raw shrimp yielded a total count of less than 100,000 per gram. There were no samples of frozen, raw, green shrimp with counts under this number. Both breeding and batter mixes contributed significantly to the total number of microorganisms.

Cocciase-positive staphylococci were not detectable in any of the samples purchased in retail food stores. It was impossible to determine the age of these samples since storage histories and catch data were not available. One may infer only that this organism does not remain viable in samples subjected to prolonged frozen storage and that no information would be forthcoming from procedures designed for their detection in these samples.

In all but one sample of unfrozen, raw, green shrimp, and in all samples of the finished, frozen, breaded product received directly from the producer, cocciase-positive staphylococci were present. It became evident that the inclusion of cocciase-positive staphylococci in any microbiological analysis was required.

Further study of the results of coliform and enterococci determinations revealed that the number present of the latter may be a more reliable indicator of the degree of sanitation practiced during processing of the product. The magnitude of the total counts paralleled more closely the occurrence of greater numbers of enterococci in all of the products examined than did the coliform counts. Previous work reported by Fellers et al. (1958) has demonstrated that enterococci are more resistant to frozen-storage temperatures than are coliform organisms, because survival curves of the latter show a steady decrease in numbers of viable organisms with time in storage. It is possible that high enterococci and total counts coupled with low coliform counts indicate extended frozen storage of the frozen breaded shrimp prior to actual sale to the consumer.

2. 1126

fishing ability between the hangings No. 2 and No. 3 was insignificant. The different hangings presented the following percentages of the total catch: monofilament nylon: (1), 26.0; (2), 37.7; (3), 36.3. Spun nylon: (1), 29.7; (2), 36.4; (3), 33.9. The correlation between the hanging and the catches obtained is largely in agreement in both groups of material. There seems to be, however, a comparatively lower fishing ability in the monofilament nylon with narrow meshes. The mesh opening of the net increases in size when the distance between the knots along the corkline becomes larger. It may, therefore, perhaps be anticipated that the greater catches in (2) and (3) should have been caused by the larger mesh opening of these nets. When the catch per mesh unit is calculated, the results prove that it is the hanging itself, not the size of the nets, which is largely responsible for the variation in catching ability. It is pointed out that the best results are obtained when the meshes are hung not closer than in (2), i.e., that the distance between meshes in hanging should be about 5% less than the length of the mesh bar. This should apply to all mesh sizes. But due regard should be taken of the shrinking or stretching qualities of the corkline.

3. 2490

end of 2 months, thawed for 24 hours at 40° F., and then filleted. Some drying was noticeable on the skin of the plaice at the end of 1 month; however, the fillets were normal and without evidence of discoloration or drying of the flesh.

At the end of 2 months, both the frozen and the thawed samples showed only slight desiccation. The fillets from these samples, however, were bright yellow to yellow brown on the skin side and not saleable. The difference between the gutted plaice and ungutted plaice and between those stored at -10° F. and at +10° F. was not significant. The longer period of frozen storage, however, resulted in a brown instead of a yellow colored skin. Both the yellow and the brown discoloration apparently resulted from a change in the fat of the fatty layer immediately beneath the skin and along the lateral line. Some increase of free fatty acid in the fat from the plaice stored at 10° F. was apparent, but peroxide values had increased very little. Salt extractable protein, a measure of the protein deterioration and its increasing insolubility on frozen storage showed little change.

Conclusions. --Discoloration of the flesh beneath the skin occurred in both ungutted and gutted plaice after a very short time in frozen storage. The development of the discoloration did not appear to be affected by the length of time the fish were held in ice before they were frozen. Ungutted fish should not be held in frozen storage for longer than 1 month if discoloration is to be avoided.

3. 239

are reported (see Reito [Refrigeration], 28, No. 313, 6 (1953)).

3. 2465 DENATURATION OF FISH PROTEINS

Lutjzen, A. F., M. G. (Central Institute for Nutrition Research T. N. O., IJmuiden, The Netherlands)
 Nature 180, 1422-1423 (December 21, 1957)

According to Love (1956), the toughening of cod that has been stored at -30°C . does not always involve decreased protein solubility. This paper is a further report on the influence of the freezing-rate on the denaturation of fish held in frozen storage.

Experimental. -- Soluble nitrogen in quick-frozen samples of cod that had been stored at different temperatures was extracted with 5-percent sodium chloride solutions at pH 7.0 to 7.5, according to Dyer's method and determined by micro-Kjeldahl assay. Toughening of the thawed and boiled cod muscle and the amount of soluble nitrogen in the cod muscle were compared at regular intervals.

Results. -- A close relation was always found between the increase in toughness after boiling and the decrease in the ratio of soluble nitrogen to total nitrogen in samples that had been stored at -10°C . This correlation was absent in samples that had been stored at -20°C . and at -30°C . All of the above samples had been frozen in an air-blast freezer at a rate of cooling sufficient to lower the center of the fish from 0°C . to -3°C . in about 20 minutes. The soluble nitrogen content of the samples just after freezing was rather low. Ironside and Love (1956) reported similar low soluble nitrogen values for fish especially when the samples contained myocommata tissue such as the above samples of cod muscle. Consequently, the soluble nitrogen or protein is expressed as a percentage of total nitrogen. These findings, and soluble nitrogen or protein is expressed as a percentage of total nitrogen, cannot be used as an objective standard for the toughness of fish that had been held in frozen storage.

In cod of varying degrees of freshness when quick frozen and stored at -10°C . protein denaturation proceeds more rapidly and to a lower level of soluble nitrogen in fresh samples than in samples

(over)

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4, PAGE 13
 UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

ABSTRACTER: Martin Heerd

3. 3341 OYSTER STEW IS MADE FROM RECAPTURED JUICE

Anonymous
 Food Packer 38, 12 (November 1957)

A new oyster stew, made from oysters that have been canned in their own recaptured liquid, is being packed by a Biloxi, Mississippi firm.

Oyster stew usually is made by canning whole oysters and oyster meat in a liquid containing dried milk and flavoring materials. None of the natural liquid gets into the stew because when oysters are opened by steaming, their natural juice flows from the shells and is lost.

A simple, mechanical method has been devised for recapturing this oyster liquor. After it is collected, the liquor is double filtered, pasteurized, and mixed with the seasoning mixture of the oyster stew.

The whole oyster meats and the liquid mixture are filled into the cans, and the cans are sealed, heat processed, labeled, cased, and shipped to dealers throughout the country.

Shrimp cooker. -- The same company is using an automatic shrimp-cooking device that moves the baskets of shrimp through the cooker by means of a worm gear. The speed at which the worm gear turns is controlled by metering air, so that it is set manually to conform with the size of the shrimp being cooked--the larger the shrimp, the slower the worm gear turns and the longer is the cooking process.

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4, PAGE 13
 UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

ABSTRACTER: Kathryn L. Osterhaug

DENATURATION OF FISH PROTEIN

RECAPTURED OYSTER LIQUID

3. 4

COMPARISON OF SMOKE PRODUCTION METHODS

Weir, C. Edith
 Food Manufacture 32, 566 (December 1, 1957)

Frankfurters smoked with smoke from a sawdust fire were compared with frankfurters smoked with smoke from a friction smoke-generator in a study made at the American Meat Institute.

Experiment 1. -- In the first experiment, one lot of frankfurters was smoked with sawdust-generated smoke; a second lot of frankfurters was smoked with friction-generated smoke that had been passed through filters being sprayed with water at the rate of 1 1/2 gallons per minute; and a third lot of frankfurters, with friction-generated smoke that had been passed through filters being sprayed with water at the rate of 3 gallons per minute.

The friction-generated smoke gave a somewhat milder flavored frankfurter when the three gallon per minute spray was used than when the 1 1/2 gallon per minute spray was used.

Experiment 2. -- In experiment two, one lot of frankfurters was smoked with sawdust-generated smoke, whereas a second lot of frankfurters was smoked with friction-generated smoke that had been passed through 1-inch and 3/4-inch mesh filters, the latter being continuously sprayed with water at the rate of 1 1/2 gallons per minute.

The friction-generated smoke contributed less charcoal flavor to the frankfurters than did the sawdust-generated smoke. Intermittently sprayed friction-generated smoke gave a less acid and sweeter flavored frankfurter than sawdust-generated smoke. The continuously sprayed friction-generated smoke gave the frankfurters a crescent or phenol type of flavor more frequently than the intermittently

(over)

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4, PAGE 13
 UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

ABSTRACTER: Martin Heerd

3. 5 THE PROCESSING OF DRIED SALTED FISH

Beatty, S. A., and Fougere, H. (Fishery Technological Station, Halifax, Nova Scotia)
 Bulletin No. 112 Fisheries Research Board of Canada, 54 pp. (1957) (Ottawa)

CONTENTS

CHAPTER

- I. The Care of Fish at Sea
- II. Dressing
- III. About Salt
- IV. How Salt Cures Fish
- V. The Relation Between Amount of Salt Used on Fish and Type of Cure
- VI. Methods of Salting
 - Heavy salted fish
 - Light salted fish (Gaspé cure)
- VII. A Quantitative Study of Yields
- VIII. Bacteria and Other Microorganisms Concerned

(over)

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4, PAGE 13
 UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

Reprinted in part

COMPARISON OF SMOKES FOR FRANKS

PROCESSING DRIED SALTED FISH

3. 3341

3. 5

With fish curing
The "red" halophilic bacteria
The "dun" molds

IX. Machine Washing

X. Drying Salt Fish

3. 2495

3. 4

in a rather advanced stage of spoilage. According to these findings, the action of bacteria and enzymes apparently decomposes the proteins to such a degree that they are less liable to denaturation. Dyer (1951) reports that protein denaturation in frozen white fish has always been considered to be associated with toughness. Accordingly, denaturation as a result of freezing is fundamentally different from protein denaturation caused by heat. Denaturation in frozen fish customarily results from the action of concentrated salt solutions on the soluble proteins. These salt solutions originate from the liquid in and around the cells when pure water freezes out.

Protein denaturation in fresh fish never has been demonstrated at temperatures ranging from $+24^{\circ}$ to -1° C.; however, this does not prove that fish protein is not liable to heat denaturation at these temperatures. The rate at which fish proteins are broken down by the action of bacteria and enzymes possibly is so high at these temperatures that denaturation cannot be demonstrated.

To prove this hypothesis, sterile native cod-fish proteins were stored at temperatures above 0° C. A few of these samples of cod tissue were hermetically sealed in cans, sterilized by gamma irradiation, and stored at 10° C. and at 24° C. In these samples, protein denaturation was demonstrable. A radiation dose of 0.5×10^6 rad was necessary to obtain sterile samples. With this amount of irradiation the soluble nitrogen in the cod tissue decreased from 88 to 74 percent. After 13 days of storage at 10° C., the soluble nitrogen content of two samples of irradiated cod tissue decreased to 26 and 27 percent soluble nitrogen, respectively. After 16 day's storage at 24° C., the soluble nitrogen content of three samples of irradiated cod tissue decreased to 22, 23, and 24 percent, respectively. An indication of the velocity of this denaturation was not obtained; however, in the samples that had been stored for 14 days at 10° C., soluble nitrogen had not yet reached the minimum. The soluble nitrogen content in identical samples that had not been irradiated was 24 percent soluble nitrogen after boiling. The minimum value for nonirradiated samples that had been stored for a very long time at -10° C. was about 20 percent soluble nitrogen.

In the above experiments irradiated samples were studied. Because much protein is denatured by irradiation itself it is possible that the denaturation that occurred during storage had been induced by irradiation.

sprayed friction-generated smoke. These frankfurters, however, were closer in flavor to the sawdust smoked frankfurters than frankfurters that intermittently had received sprayed friction-generated smoke.

This article originally appeared in the American Meat Institute Foundation Circular No. 35, 1957.

3.4 A RATIONAL PROCEDURE FOR THE HOT-SMOKE-CURING OF FISH

Tilgner, Damazy Jerzy (Politechnika Gdanska, Poland)
Food Manufacture 32, 365-368 (August 1957)

The quality of hot-smoke-cured meat and fish products depends upon rigid control of temperature, humidity and air speed, of the wood and methods used for smoke generation, and of the kind and quality of the raw products. The technique determines the quality and quantity of smoke constituents deposited on the tissue of the product and affects color, flavor, palatability, and storage life. Climatic conditions and the human factor cause large variations in product quality as well as yield. Fuel consumption and the method of curing are also important.

Three fundamental requirements for rationalizing the hot-smoke-curing process are: (1) reduction of the water content of the product by 15 to 30%; (2) denaturation of the protein with heat; (3) smoking to improve flavor and storage life. These requirements may be achieved by: (1) removal of the water when the product is at the wet-bulb temperature; (2) Thermal denaturation of the tissue at temperatures of 76° to 82°C. (170° to 180°F.); (3) Addition of the proper curing and coloring smoke during drying if practical. This has proved advisable with herring and sprats but not with cod. The proper smoke must be obtained by rigid control of the thermodynamic and physico-chemical conditions that influence the composition and amount of curing smoke. The amount of phenols, volatile organic acids, and total solids in the smoke were found to be highly correlated with smoke density.

The required surface coloring of the product does not depend on the amount of phenols but does exist between the neutral or resinous constituents of the smoke; however, a correlation does appear to exist between the neutral constituents and the phenols. Those smoke constituents that are volatile in steam vapor are responsible for the desirable aroma and flavor characteristics. They consist of aldehydes, ketones, acids, and volatile phenols. A hot-smoke cure may introduce 4 to 6 mg. of phenols per 100 g. of meat and an even, deep-golden metallic color on the surface.

(over)

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4 PAGE 15
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

ABSTRACTER: John A. Dasso

3.4 FREEZING -- SMOKED FISHERY PRODUCTS

Sukrotov, I. I. and Podsevalov, V. N.
Sbornik Khimicheskikh No. 3, p. 27 (1956) (Moscow, U.S.S.R.)
World Fisheries Abstracts 3, 33-34 (September-October 1957)

Hot-smoked anchovies are tasty but do not keep well, which makes it impossible to prepare them in large quantities at the point of production. The quality of anchovies preserved for a long time under refrigeration also deteriorates on account of the oxidation of the fats. Salting, drying and smoking tests have been conducted. The best results are obtained with a 5 to 7% salting and a smoking temperature not exceeding 95° C. (203° F.). The smoking process is called 'half-heat smoking' and is carried out as follows: fish are delivered to the smoking installation where they are washed, then salted in a refrigerated tank. The anchovies are then strung on frames and loaded into the boxes or into smoking rooms prior to freezing. The anchovies to be packed are frozen after packing.

Fresh anchovies should be preserved under refrigeration at about 0° C. (32° F.). The washing temperature should not exceed 10° to 12° C. (50° to 53° F.). A chart shows the variations of the weight of anchovies in relation to the various salting temperatures. A bacteriological count was made at various production stages and the results obtained are also given.

See table, over.

(over)

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4 PAGE 15
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

HOT-SMOKED FISH

FROZEN SMOKED ANCHOVIES

3.5

CHANGES OCCURRING IN THE FAT DURING THE PROCESSING OF SALT FISH

Cardin, Alme and Bordeleau, M. A. (Fisheries Technological Station, Grande-Riviere, Quebec)
Fisheries Research Board of Canada, Progress Reports of the Atlantic Coast Stations No. 66,
pp. 16-17 (September 1957)

Purpose. --This study was made to obtain a basic knowledge of the extent of hydrolysis and oxidation that occurs in the fatty lipids of cod muscle during salting and drying.

Experimental. --Codfish in lots of 200 pounds each were processed as a light salt cure (Gaspé cure) and a heavy cure. Two samples, each of which contained about 3 pounds of the cod muscle, were taken from both the light salt cure and the heavy salt cure at different representative steps during the curing process. These samples were extracted by refluxing them for 4 hours successively with acetone, ethyl alcohol, and petroleum ether. Both the acetone and the alcohol extracts were freed from the solvent and the water- and oil-mixture was extracted with petroleum ether. Total lipids extracted varied between 3.8 and 5 percent of the dry weight of the cod muscle or about 0.7 percent of the wet weight of the cod muscle.

The total lipid extract was separated into a phospholipid and a glyceride fraction. The glyceride fraction was subjected to tests for (1) the extent of hydrolysis, (2) the extent of oxidative rancidity, and (3) the amount of fatty acids liberated by recording the variations in unsaturation (iodine value) and mean molecular weight (saponification equivalent).

Findings. --In codfish prepared according to the light cure, the maximum amount of free fatty acid in the fat reached progressively during salting and drying probably occurred at a concentration of 12.7 percent salt in the cod muscle or at the end of the drying period. In codfish prepared by the

(over)

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4 PAGE 15
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

ABSTRACTER: Martin Heerd

4.13

LOOK TO THE SEA

Ronayne, Mark
Trade News 10, 3-13 (November 1957)

Fishery technologists throughout the world are working in a frontier land. Although among the oldest of man's endeavors, fish catching and processing still are developing. Evidence of this is provided by the continuing studies and experiments designed to find and develop new ways of catching, processing, preserving, and utilizing the resources of the sea.

Scientists at the Halifax Technological Station of the Fisheries Research Board of Canada are seeking, by means of fundamental and practical research, to find the answers to two general problems:

1. How best to utilize the fish resources--food fish, rough fish, and byproducts--to manufacture a wider range of products that are more valuable than those now coming from the fisheries.
2. How best to retain the quality characteristics of the wide variety of food products marketed by the Canadian fishing industry.

Fish flour. --An example of a new use for fish is the development of a process for manufacturing so-called fish "flour" from fish and fish offal. The term "flour" is a misnomer; the product is an almost white, fine textured material that is rich in high quality protein. It is both odorless and tasteless.

The potential uses for this fish protein product have not been fully explored as yet. It holds

(over)

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4 PAGE 15
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

Reprinted in whole

ABSTRACTER: Kathryn L. Osterhaug

CHANGES IN FAT OF SALT COD

CANADIAN TECHNOLOGY

3.4

Output of the various stages of production of frozen smoked anchovies

Process	Output of each operation (%)	Output related to fresh fish (%)
Fresh	100.4	100.0
After washing	98.0	98.0
After salting	98.5	96.5
After smoking	72.0	68.5
After packing	89.0	68.8
After freezing	99.5	68.5

3.4

Table 2. --Curing smoke density and average optical density

Optical smoke density-- points of scale	2 (very light)	4	6	8	10 (very heavy)	correlation coefficient (r)
Volatile organic acids (mg./m ³)	133.91	234.96	383.13	522.13	736.30	0.993
Phenols* ...	70.73	90.03	143.45	182.50	269.73	0.983
Total solids (g/m ³)	0.1139	0.5893	0.8572	1.5111	2.0271	0.998
Deposition of solids on horizontal sur- face (mg./100 cm ² / hour)	1.32	4.58	8.81	10.70	16.05	--

* By the bromometric method $C_6H_5OH + 3Br_2 = C_6H_2Br_3OH + 3HBr$ which was titrated iodometrically.

Hot-smoke-curing was undertaken in a controlled fish smoking kiln that would allow a considerable increase in the intensity of the smoking process. This kiln consisted essentially of a drying chamber with overhead circulation and electric strip heaters at the top. Sawdust and chips were used for smoke production. Air and smoke were circulated at 594 feet per minute in the empty kiln and at 182 feet per minute in the loaded kiln. Loading density was 1.74 to 2.49 pounds and 1.04 to 1.15 pounds per cubic foot respectively, for Baltic herring and cod or sprats. Average temperature of 167°F. was reached in herring tissues 10 to 12 mm. thick after 30 min. at 201°F. these findings was the total smoking time for the dynamic hot smoking process developed from these findings was considerably shorter than the total smoking time in natural draft kilns with open fire hearth. Smoked herring that yielded 81 percent of smoked product showed no detectable deterioration after 10 days of storage in plain paper packaging at room temperature. Other fish species showed similar improvement in quality when smoked by the above process.

4.13 (Cross Reference: 6.54)

exceptional promise for populous countries that are faced annually with food shortages, and can be used as a special dietary supplement for people with nutritional problems. One pound of the fish protein is said to be equivalent to the protein in 5 pounds of beefsteak. Even at 50 cents a pound, which reportedly would be an exorbitant price, it would still be a cheap source of excellent quality protein.

Utilizing the viscera.--At present, the viscera from all fish that are caught by trawler on the high seas and from practically all of those that are caught inshore by small boats are discarded. Analysis by scientists indicates that this material is of great potential value and can be used to make byproducts for human and animal consumption.

Meal made from the fish viscera has been found to contain a large proportion of protein in pre-digested form and large quantities of B vitamins. Potential products that can be extracted from the crude viscera meal include pure cholesterol and the amino acid, lysine, in which many other proteins are deficient.

Research on herring oil.--The approach of the scientists at the Halifax Technological Station is concerned with the separation of the many components found in herring oil by the use of the most economical methods available.

To be able to do this, a considerable amount of fundamental knowledge, including the properties of the various components of the herring oil, must be available. The size of the problem is indicated by the fact that in spite of the size of the herring oil industry, no one can give a complete analysis of the components of the oil or can describe their individual properties.

The Halifax scientists have separated herring oil into a number of different fractions. The original oil, which had no specific properties of its own, is thus replaced by a number of fractions having specific properties that can be used for various purposes.

3.5

heavy salt cure, most of the free fatty acids in the fat were formed during the first 10 days of salting during which time the concentration of salt in the cod muscle reached 15 percent.

Marked hydrolysis in the fatty lipids of the cod muscle occurred at each representative step in the process during light salt curing. The production of free fatty acids in the fat was initiated during the salting period and reached a level of 50 percent fatty acids at the end of the drying process. Half of the fat had been hydrolyzed by this time, but true rancidity had not occurred. At no time during the light salt cure was there a decrease in either the iodine value or in the saponification equivalent of the fat.

In codfish muscle cured in heavy salt, the rate of hydrolysis of fat was high during the first 10 days of salting, when salt penetration is rapid. During the last half of this salting period the rate of hydrolysis of fat was reduced considerably although the conditions in the brine remained the same as during the first 10 days of salting. Only a small increase in fatty acids occurred during 8 days of drying. The free fatty acid content at the end of the drying process was 50 percent fatty acid as in the case of the light salt cure.

According to the data obtained, a concentration of 15 percent salt in the flesh will inhibit the lipolytic action of cod muscle enzymes. Fatty acid unsaturation increased considerably during both types of cures and continued at a high level from the 10th to the 36th day of salting in the heavy cure.

STUDIES ON THE NUTRITIONAL AND PHYSIOLOGICAL EFFECTS OF THERMALLY OXIDIZED OILS

Johnson, O. C.; Perkins, E.; Sugai, M.; and Kummerow, F. A. (Department of Food Technology, University of Illinois, Urbana)
Journal of the American Oil Chemists' Society 34, 594-597 (December 1957)

Purpose. -- This paper is concerned with two studies: (1) The rate of absorption and the in vitro rate of hydrolysis of thermally oxidized corn oil and (2) the effect of a diet containing 20 percent of thermally oxidized corn oil on the livers of rats.

Experimental. -- Corn oil was thermally oxidized at 180°C. by bubbling air through it at the rate of 200 ml. per hour for 24 hours. The spectrophotometric method of Brice et al. (1954) was used to determine the linoleic acid content of this oil. Rats used in these studies received a diet composed of 2 percent castor, 44-percent cerelone, 5-percent Wesson-salt mixture, and 20 percent of either the fresh or the thermally oxidized oil. Water-soluble vitamins were added to the diet, and fat-soluble vitamins dissolved in hydrogenated coconut oil were given to each rat once every five days by medicine dropper. In very viscous oxidized oils were fed, they were added to the diet at a 10-percent level. When the rats would not eat diets containing 20 percent of these oils, a Urea separation of the thermally oxidized oil fatty acids was made by a modification of the procedure reported by Swern (1955).

Several oils were thermally oxidized under the standard conditions, and these oils then were fed to male weanling rats in the test diet. The growth of these rats was expressed as the ratio of the average gain of six animals on a diet that contained thermally oxidized oil to the average gain of six rats on a diet that contained fresh oil. The experimental diet period was 10 days, and all rats

(over)

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4, PAGE 17
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

ABSTRACTER: Martin Heerdt

REDUCTION INDUSTRY IN B. C.

Swann, L. G.
Trade News 10, 3-5 (October 1957)

The bulk of 200,000 to 300,000 tons of herring landed annually by British Columbia fishermen is processed into fish meal and oil. Farm stockmen and poultrymen take all of the meal; virtually all of the oil is used in the manufacture of shortenings, margarines, and other food products.

The meal output of fish-reduction plants at one time was sold mainly for fertilizer. Herring oil was used to make soaps, detergents, and bases for cosmetics. When pilchards were caught in quantity the oil from this species was used to a considerable extent in manufacturing paints and varnishes. Rising costs of the raw material and of processing placed fish meal and oil beyond the economic scope of those early outlets. All of these byproducts now are used in one form or another for human or animal consumption.

Basic process. -- In all reduction plants the fish travel through the plant in planned progression from the fishboat or packer, until they emerge in bags as meal or in tanks as oil and condensed fish solubles. There may be slight variations between one plant and another, but all use the same basic process.

Herring are unloaded from the boat to the plant either by pumping or by a "marine leg." The former is the most up-to-date method, and, as its name implies, is a matter of centrifugal action, which draws the fish from the hold of the ship through large pipes and into the storage bins of the reduction plant.

The marine leg is a movable steel derrick, carrying endless chains fitted with hinged steps. Herring are fed from the ship onto this constantly travelling elevator and thus are carried into the plant.

From the fish bins, the material is taken by elevators and passed into cookers. These are large

(over)

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4, PAGE 17
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

ABSTRACTER: Kathryn L. Osterhaug

TOXIC EFFECT OF OXIDIZED OILS

B. C. HERRING REDUCTION

BROILER TRIAL INVOLVING FAT LEVELS, PELLETING, CHICK SOURCE, MHA AND FISH MEAL SUPPLEMENTATION

Combs, G. F.; Helbacka, N. V.; and Nicholson, J. L. (University of Maryland, College Park)
Feedstuffs 30, 62-64 (January 4, 1958)

Comparisons made were between 2 and 10 percent levels of added stabilized vegetable oil (fat) in pelleted rations and 10 percent levels of added fat in mash rations in two different series of rations supplemented with animal proteins. Series A rations were supplemented with 5 percent fish meal and 0.5 pounds of methionine hydroxyanalogous calcium salt (MHA) per ton. Series B rations were supplemented with hydrolyzed feather meal, poultry byproducts meal, and meat and bone scraps. MHA also was evaluated as a supplement in these rations.

Experimental. -- In all, 16 pens of crossbred chicks were used in this feeding study. Equal numbers of each sex were placed in each pen. Eight of these pens contained 400 V. crosses male X Arbor Acre White Rock female crossbred chicks and eight of the pens contained 400 V. crosses male X Nichol 108 female crossbred chicks. Eight different rations were fed. One group of each of the crossbreeds received each ration.

Feeding trials were terminated when the broilers reached 8 weeks of age, and broiler weights and feed consumption were tabulated. Three male and three female broilers from each crossbred chick source were selected for quality evaluation, processed at 126° to 128° F., defeathered in an automatic picker, and scored for pin feathers, finish, abdominal fat, conformation and fleshing, barking, and pigmentation. The highest subjective score indicated the most desirable broiler conformation. Also determined were the percentage of blood loss, liver weight loss, and dressing loss (New York dressed ready to cook).

Results. -- The data have been averaged, combined, and tabulated (see over). In the comparisons that involved either 4 or 6 groups per treatment, rations that contained 10 percent added fat in pellet form did not promote any more rapid growth than did rations that contained only 2 percent added fat

(over)

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4, PAGE 17
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

ABSTRACTER: Martin Heerdt

BIOLOGICAL VALUE OF PROTEINS

Anonymous

Nutrition Reviews 15, 337-338 (November 1957)

A recent review (Nutrition Reviews 15, 151 (1957)) has again focused attention on L. B. Mendel's proposal of many years ago that the biological values of a protein is dependent on the minimum quantity of any essential amino acid made available from it (Nutrition: The Chemistry of Life, Yale University Press, New Haven, Conn., 1923).

On the basis of Mendel's concept, H. H. Mitchell and R. J. Block (J. Biol. Chem. 163, 599 (1946)) evolved a system for protein evaluation based on amino acid content. With whole egg as a standard, the relative value of the protein was expressed as a "chemical score" equal to the greatest percentage deficit in an essential amino acid in the test protein. Although the above system has been modified several times, many limitations may be anticipated in attempting to predict the biological values of proteins from their chemical composition (H. H. Mitchell, Nutrition Reviews 10, 33 (1952)). One of these is the rate of release of amino acids during digestion (Nutrition Reviews 15, 151 (1957)).

Although the results of in vitro digestion of various proteins with pepsin gave amino acid release values varying from approximately 90 percent in egg albumin to 45 percent in white flour proteins, it would nevertheless seem of importance in cases where there is some indication of essential amino acid proportions among different food proteins. E. Kornauy (Physiol. Chemie 305, 61 (1956)) has recently developed a simplified method for the determination of lysine in proteins and has related the concentration of this amino acid to a predicted nutritive value, disregarding the digestibility of the protein and other factors. The method consists essentially of isolating lysine by a

(over)

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4, PAGE 17
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

Reprinted in whole

FISH MEAL FOR BROILER RATIONS

BIOLOGICAL VALUE OF PROTEINS

cyllinders through the center of which runs a worm screw, which is the means of propulsion at this stage. Tests of time are measured into the cylinder while the herring slowly progress down its 40 odd feet of length by means of the revolving screw. Steam comes into direct contact with the fish, and when they emerge from the cylinder they are cooked thoroughly.

Meal, oil separated. The next step is the press, designed to separate liquor from what--in the next stage--is referred to as "cake." This is the parting of the ways; the stage at which potential fish meal and fish oil begin to travel separate paths.

The press cake goes through a "fluffer," which breaks the cake sufficiently to facilitate its feeding into the drier. At one end of the huge rotating cylinders as much as 70 feet in length and up to 10 feet in diameter. At the other end, a fan creates a forward draft. The propulsion at this stage comes from a mixture of gravity and suction. Inside the drier, steel flights pick up the cake and carry it upwards while the drier rotates. At the top of the turn, gravity causes the cake to drop, to be picked up, and to drop again, time after time. The steady suction moves it forward at a predetermined rate of progress through, intensely heated air, until it is expelled at the far end in a rough form of meal.

Meal from herring goes straight to the hammer mill, where the rough meal is ground fine enough to pass through a screen. Meal from salmon oil is spread on the floor for extra drying or cooling in order to prevent spontaneous combustion. After passing through the hammer mill, the product finally is called fish meal. Modern reduction plants in B. C. have capacities of output ranging from 10 to 40 tons of meal per day.

The liquor is first "screened" after leaving the press, and solids extracted at this stage are returned to the meal line. In some plants, the liquor then goes to settling tanks, a series of four steel tanks in which the first stages of oil separation occur. The first tank is slightly higher than the second; the second, slightly higher than the third; and the fourth, lowest of all. They are connected by "weirs"--small openings that allow the overflow to trickle from one tank to the other. After it is screened, liquor is piped into the first tank. As the tank fills, oil rises to the surface and eventually spills into tank number two. There is still some water mixed with the oil in tank number two, but when the process is repeated at each tank, the liquid in tank number four is as near to pure oil as this process will yield.

were restricted to the same amount of food.

Results. -- Thermal oxidation products from polyunsaturated fatty acids, primarily linoleic acid, were responsible for much of the loss of nutritional value in thermally oxidized edible oils. Oils that had a high linoleic acid content were more subject to thermal oxidation than those with a low linoleic acid content. The ratio of linoleic acid to total unsaturation also had some effect on the nutritive stability of an oil when it had been thermally oxidized. An oil with a high iodine value and a low linoleic acid value appeared to be more stable to thermal oxidation than an oil with one-half the iodine value and with most of its unsaturation due to linoleic acid. Products of thermal oxidation that cause loss in nutritional value did not form urea inclusion compounds. These products are probably polymeric in nature. Thermally oxidized oils also contained carboxylic acids and carbonyl groups that might have caused some of the nutritional loss which was observed when thermally oxidized oils were fed to rats.

A decrease was found in the rate of *in vitro* hydrolysis of the thermally oxidized oil when it was digested with pancreatic lipase and in the rate of absorption of this oil from the intestine of the male rats. After 24 hours, however, the percentage of oil absorbed was the same regardless of whether fresh or thermally oxidized oil was fed.

Rats that received a diet containing thermally oxidized oil were found to have a significantly larger liver-body weight ratio than rats that received diets containing fresh oil. The livers of rats that received the thermally oxidized oil in their diets, however, did not differ in amount of lipid or total solids, and histopathological studies did not show abnormal conditions.

chromatographic technique, treating the lysine first with chloramine and with Folin's phenol reagent to produce a blue color, and then determining the extinction coefficient with a colorimeter (750 mμ). According to the author, the method, if properly carried out, is accurate to plus or minus one percent.

The author points out that most human beings consume more plant protein than animal protein. Even in nonvegetarians, the ratio would appear to be from 3:1 to 2:1 in favor of plant amino acid. With this fact in mind a survey was made, utilizing the above technique, of various plant and vegetable proteins with respect to their content of lysine. The average percentage of lysine contained in each of the following proteins was: beef muscle, 10.2; calf liver, 8.4; wheat flour, 2.9; potato flour, 4.9; red cabbage, 3.2; brussels sprout, 3.7; carrot, 2.5; almond, 2.2; pea, 4.6; hazel nut, 2.4; walnut, 2.4; and peanut, 2.0.

It is quite clear that less essential amino acid, expressed in terms of lysine, is present in vegetable proteins. With the exception of the potato and the pea, the values were about one-third the average for animal proteins. The various nuts, especially peanuts, were of the least biological value if the lysine content was directly indicative of this property. Actually, vegetable proteins would seem to be of less biological value than animal proteins for two main reasons: First, as a group, they apparently contain less of this essential amino acid; secondly, they are less readily digested, at least by pepsin under *in vitro* conditions.

in pellet form. Feed conversion, however, improved from 2.22 to 2.00 pounds of feed per pound of broiler when pellets containing 10 percent fat were fed. Mash feeds with 10 percent added fat gave growth rates and feed conversion ratios that were comparable with those obtained from similar feeds in pellet form. The improvement in feed conversion, about 10 percent, was in direct proportion to the increase in calories that resulted from the addition of 10 percent fat.

The six groups of broilers that received rations containing 5 percent fish meal plus MHA were an average of 0.11 pounds heavier than the six groups that received similar treatment, except for no fish meal or MHA in their rations. This latter group required 0.04 pounds less feed per pound of weight. The addition of MHA at levels of 0.5 pounds per ton to rations that did not contain fish meal and MHA failed to improve the rate of growth, but this addition did improve feed conversion by 0.04 pounds.

Conclusions. -- The high fat feeds were not sufficiently advantageous to compensate for the premium price of calories from fat as compared with the price of calories from corn.

Table 4. -- Summary of average weight and feed conversion results (Trial S-21)

Treatment	No. of groups *	8-week wt., lb.	Feed/Weight
2% fat pellet	4	3.15	2.22
10% fat pellet	4	3.09	2.01
10% fat mash	4	3.06	2.00
12% fat pellet	6	3.13	2.22
10% fat pellet	6	3.08	2.00
No fish meal, no MHA	6	3.15	2.10
5% fish meal + .025% MHA	6	3.06	2.06
No methionine hydroxylanalogue	4	3.06	2.14
+ MHA	4	3.06	2.14
Vantress male x Arbor Acre White Rock female	8	3.13	2.07
Vantress male x Nichol 108 female	8	3.05	2.10

* 400 broilers used per group.

METHODS OF COLLECTION, COST OF PRODUCTION, AND BLEACHING OF GRACILARIA LICHENOIDES

Duraratnam, M. (Fisheries Research Station, Ceylon)
Ceylon Department of Fisheries, Progress Reports Biological and Technological No. 2, 54-55 (July 1956)

Agar weed (*Gracilaria lichenoides*) grows in the Puttalam lagoon either attached to *Thalassia* sp. or partly embedded in the mud in water ranging from 3 to 6 feet in depth. In appearance, the weed consists of tufts growing on short branches that arise irregularly from the base of the plant. The color of the agar weed varies from green to straw yellow to light purple.

Methods of collection. -- In regions where the depth of the water did not exceed 4 feet, the weed was collected by hand from a fishing canoe manned by two people. In deeper places, rates with long handles were used to gather the seaweed off the bottom. The weed was collected, it was loaded into the boat and allowed to drain free of water. On the basis of six trips, the average wet weight of weed collected per boat per trip was 141 pounds. After the weed was loaded on shore, all foreign matter was removed; and the weed was washed thoroughly in fresh water and spread out to dry in the sun. This treatment was repeated during the next 3 or 4 days until the weed was completely bleached. Wet weight 141 pounds yielded an average of 20 pounds of dry weed.

Cost of production. -- To produce dried agar weed at Kalpitaya cost 52 cents per pound or £ 85 per ton excluding the cost of transportation to Colombo. The market prices (C. I. F. London) for bleached seaweeds of the best quality were as follows in 1954: Irish Moss (*Cladonia crispus*) and *Cagarina stellata* £ 120 to 130 per ton; Eucheoma cottonii, £ 65 per ton; E. *seria*, £ 80 per ton; and unbleached "Irish Moss", £ 80 per ton. The quality of *G. lichenoides* from Ceylon is roughly equivalent to that of Eucheoma cottonii which sells for £ 65 per ton in London.

Assay. -- Samples of *G. lichenoides* assayed in England and New Zealand gave a fairly high yield (over)

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4 PAGE 19
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

ABSTRACTER: Martin Heerd

BIOCHEMICAL AND BACTERIOLOGICAL METHODS FOR DETERMINING SHRIMP QUALITY

Fellers, C. R.; Gagnon, M.; and Khatchikian, R. (Department of Food Technology, University of Massachusetts, Amherst)
Proceedings of the Gulf and Caribbean Fisheries Institute, Ninth Annual Session, pp. 23-26 (November 1957)

The biochemical activities of microorganisms in marine products have been studied extensively for a number of years, but the bacteriology and the biochemical activities of bacteria in shrimp and in shrimp products have received only limited attention.

Laboratory work was carried out to determine the validity of certain tests for detecting the conditions of sanitation and changes of quality in frozen breaded shrimp collected at packing plants and physical factors. The study was based on samples of frozen breaded shrimp collected at packing plants and retail outlets over a two-year period from 23 cities.

Out of samples collected for the survey, distribution of bacteria varied from a minimum of 21,500 bacteria per gram of shrimp to a maximum of 54 million bacteria per gram. Seven percent contained less than 100,000 bacteria per gram. Thirty-six percent contained less than 500,000 bacteria per gram. Out of the total samples, sixty-one percent had a bacterial content of less than 1 million.

The number of coliform bacteria varied from a minimum of 0 to 700 per gram of shrimp. Out of 144 samples, only 98 (68 percent) contained coliform bacteria, but of these 98 samples, 90 (92 percent) contained less than 100 coliforms per gram.

Enterococci were present in all the samples and their number varied from very few bacteria per gram to 15,000. Forty-four percent contained less than 100 enterococci per gram of frozen breaded shrimp.

(over)

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4 PAGE 19
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

ABSTRACTER: Kathryn L. Osterhaug

HARVESTING AGAR WEED

DETERMINATION OF SHRIMP QUALITY

DETERMINATION OF MICRO QUANTITIES OF METHYL MERCAPTAN IN GAMMA-IRRADIATED MEAT

Silwinski, R. A. and Doty, D. M. (American Meat Institute Foundation and Department of Biochemistry, University of Chicago, Illinois)
Journal of Agricultural and Food Chemistry 6, 41-44 (January 1958)

A sensitive method for determining micro amounts of methyl mercaptan produced in gamma-irradiated meat has been developed which is based on the reaction with N, N-dimethyl-p-phenylenediamine. A soluble red-colored complex is formed when methyl mercaptan is reacted with the amine solution. Hydrogen sulfide is removed by the formation of an insoluble complex in a trapping solution containing mercuric acetate. The odorous vapors from irradiated meat are carried with a stream of nitrogen into a trapping tube containing the mercuric acetate. The color is developed by adding a mixture of the acid amine solution and Reissner's solution. The intensity of the soluble red-colored complex developed is measured in a photoelectric spectrophotometer, at a wavelength of 500 mμ. The method can be used for the quantitative estimation of 5 to 110 γ of methyl mercaptan.

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4 PAGE 19
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

Authors' summary

BONE DETECTION IN FISH BY X-RAY EXAMINATION PART 2. FLUOROSCOPIC EXAMINATION OF FROZEN FRIED FISH STICKS

Powell, J. J. (U. S. Fish and Wildlife Service, Fishery Technological Laboratory, East Boston, Massachusetts)
Commercial Fisheries Review 19, 1-3 (November 1957)

Frascatore and Holston (1955) employed photographic X-ray examination for the detection of bones in fish blocks and fillets. Although that method proved to be accurate, it was time consuming and expensive. Fluoroscopic X-ray examination for bone detection in fishery products was suggested as being a quicker and more practical means of solving this problem.

This paper reports the preliminary experiments employing the suggested fluoroscopic X-ray technique. The immediate purpose of this test is to develop a routine quality-control measure for use in commercial plants and for grading procedures in the application of the voluntary United States Standards for fishery products. The ultimate purpose, however, is to acquire information that will aid in the development of a routine, continuous method of bone detection in fishery products while they are being processed commercially.

Objectives. -- The specific objectives of the present study were as follows: (1) to determine the optimum conditions for use and operation of available X-ray fluoroscopic equipment, and (2) to determine the reliability of the fluoroscopic method when applied to the detection of bones in frozen fried fish sticks.

Experimental. -- The first problem was to determine the optimum energy levels at which to view the test samples. Approximately 50 pounds of fresh haddock or scrod haddock filets (each

(over)

COMMERCIAL FISHERIES ABSTRACTS VOL. XI, NO. 4 PAGE 19
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

ABSTRACTER: Kathryn L. Osterhaug

DETERMINATION OF METHYL MERCAPTAN

BONE DETECTION BY X-RAY

7. 81

To study the biochemical aspects of the spoilage of shrimp, many analytical methods were applied. Indole determination, iodine titration, trimethylamine, and Photoelectric Reflection Number appeared to be of negligible value in estimating the degree of freshness in frozen breaded shrimp. The only test that showed a definite correlation with the taste panel score and the logarithm of the total bacterial count was the ratio of total volatile bases (TVB) to total nitrogen (TN), multiplied by 100 (TVB/TN x 100).

The results obtained showed a definite correlation with the average taste panel score and the logarithm of total bacterial count. Considerable variations were obtained in the Total Volatile Bases content of different lots and of individual samples within a lot. These variations could be accounted for by the combined variation in percent of breathing and of moisture and the total nitrogen of the lots and individual samples within a lot.

The ratio (TVB/TN x 100), when plotted against time, showed a curve that almost could be satisfied by a cubic equation. The ratio was found to increase, in the samples undergoing the storage test, from a value of 6.0 to a value of 7.4 where it remained stationary and then increased to a ratio value of 10.0. On the basis of the correlation with the average taste panel scores, four zones were defined in relation to a critical ratio value of 8.0, which corresponded to a critical point for quality of frozen breaded shrimp.

The Zones were interpreted as follows for frozen breaded shrimp:

Ratio Values (TVB/TN x 100)	Quality
Below 6.0	Very good
Between 6.0 and 7.5	Good
Between 7.5 and 8.5	Questionable
Higher than 8.5	Unacceptable

Summary. -- Tentatively, a total count of more than 1 million bacteria per gram means frozen breaded shrimp of low sanitary quality, whereas one in excess of 2 million means shrimp of questionable sanitary quality. It seems that the enumeration of enterococci is a better index of sanitary quality than coliform bacteria. The ratio of TVB/TN x 100 is the chemical test of choice.

6. 33

of low grade agar, but the starch and albuminoids probably would prove difficult to extract. Because the ash content ran 8.1 percent, the agar probably could not be used in many food products without further processing to reduce the ash to about 2 percent. The assayers also reported that a high percentage of foreign matter would have to be removed before the product could be used for any industrial purpose.

Effect of various treatments. -- Experiments were conducted to determine the agar content and gel strength of seaweeds washed in fresh or salt water and bleached on wire netting, canvas, grass, sand, or wooden trays. Samples washed in fresh water gave higher agar yield with a lower melting point and a higher setting point for a 1 percent agar solution than samples washed in sea water. The drying surface did not seem to have any appreciable effect on the melting and setting points of the agar solution.

Bleaching experiments. -- Samples were bleached experimentally on grass, sand, canvas, wooden trays, and wire netting suspended over sand. On sand or grass with overnight exposure, the agar weed bleached faster at Kalpiya than at Colombo, probably as a result of the dewfall which occurs in Kalpiya but not in Colombo. The process of bleaching also was accelerated by drying the agar weed in the sunlight. Equal amounts of G. lichenoides were dried experimentally on wooden trays in the sunlight and in shade. Agar weed required 20 hours at about 29° C. in the sunlight for complete bleaching. Agar weed dried in the shade remained unbleached, and after 7 days it began to decompose. On wire netting, the rate of drying does not appear to affect the agar content.

Another species of agar weed (*Gracilaria confervoides*) that is found in Koddar Bay, Trincomalee is comparable with Japanese Grade I Agar producing weed. Collection and propagation of this species in Ceylon will be investigated.

7. 89

fillet contained at least one bone) were viewed on the fluoroscopic screen with the current ranging from 2.5 to 9.5 milliamperes and the potential ranging from 40 to 85 kilovolts. The clearest and sharpest image on the screen was obtained at a setting of 8 to 9 milliamperes and 60 to 70 kilovolts.

The continuous use of such high-energy levels for over 3 minutes would be detrimental to the X-ray tube, causing it to overheat. To solve this problem, the instrument was operated for 2 minutes and then turned off for an equal period. When this procedure was followed, the image produced on the screen was sharp and clear.

To test the effectiveness of the method, 3,301 frozen fried fish sticks were obtained from several commercial plants. The fish sticks were removed from the package prior to being fluoroscoped. The fish sticks that were shown to contain bones by this method were designated positive; those not showing the presence of bones were designated negative. The fish sticks then were placed on a cookie pan (the positive fish sticks were indicated) and were cooked in an oven at 400° F. for 15 minutes. The cooked fish sticks were removed from the oven and allowed to cool. They then were crushed and shredded by hand to feel for bones and thus check the accuracy of the fluoroscopic examination.

Conclusion and recommendation. -- The results of this study indicated that the X-ray fluoroscope, when operated under the conditions stated, will detect 98.5 percent of the bones present in frozen fried fish sticks.

The detection of bones in frozen fried fish sticks by fluoroscopic X-ray examination can be applied to routine quality-control. This method also can be used by the Federal Inspection Service for grading frozen fried fish sticks. Whether this method can be applied to continuous plant inspection has yet to be determined. Further tests should be conducted to determine the feasibility of detecting bones in frozen fishery products on a continuous inspection basis using industrial-type fluoroscopic X-ray units.

7. 83

0. 38	SPECIFICITY OF TRIAMINEOXIDASE Tarr, H. L., A. Journal of the Fisheries Research Board of Canada <u>5</u> , 187-196 (November 1940) (Abstract of this article appears under 2, 01 page 1 - August 1957)	2. 118	AN ATTEMPT AT MEASURING DEFORMATION OF THE SET NET BY A FISH FINDER (PRELIMINARY REPORT) Kawada, Saburo and Tawar, Yozo Bulletin of the Japanese Society of Scientific Fisheries <u>22</u> , No. 10, 593-597 (1957) (English synopsis and figures) A fish finder can be used for detecting fish schools and for estimating the deformation of fishing gears under water, however, the distance to the reflected object measured directly from the fish finder has to be corrected because of beam angle and inclination of the object.
0. 38	THIAMINASE. XIX. DECOMPOSITION OF COCARBOXYLASE BY THIAMINASE Ikehata, Hideo and Murata, Kiku (Osaka City Univ.) Vitamins (Kyoto) <u>12</u> , 286-90 (1957) Chemical Abstracts <u>51</u> , 18027 (November 25, 1957)	2. 116	GONG AID IS A BIG HELP TO ANY SKIPPER Anonymous The Fishing News (England) No. 2306, 3 (June 28, 1957) A fishgong, designed to supplement the fishscope, is an aural monitoring unit that can be adjusted to give audible notice to the skipper, by means of "pipe," when fish of sufficient quantity are in the catchable zone.
0. 5	THE ACTION OF PSEUDOMONAS ON FISH MUSCLE: 1. ORGANISMS RESPONSIBLE FOR ODORS PRODUCED DURING INCIPIENT SPOILAGE OF CHILLED FISH MUSCLE Castell, C. H. and Greenough, Maxine F. Journal of the Fisheries Research Board of Canada <u>14</u> , 617-625 (July 1957) (Abstract of this article appears under 2, 01 page 3 - March 1958)	2. 9	A RARE FISH-POISONING PRODUCED BY CHEMICALS Brandt, A. (Jungfernstiet 12b, Stralsund, Ger.) Arch. Lebensmittel-hyg. <u>8</u> , 7-9 (1957) Chemical Abstracts <u>51</u> , 9029 (June 25, 1957) Countless persons since 1948 report fish poisoning. This results from eating fish contaminated with a war-gas from a container dumped south of the Danish Isle of Bornholm at the end of the war. The poison is concd. in the fish's gill. When the heads are removed from the catch, after bringing them in an inverted position no toxicity is noted.
0. 5	THE ACTION OF PSEUDOMONAS ON FISH MUSCLE: 2. MUSTY AND POTATO-LIKE ODORS Castell, C. H. and Greenough, Maxine F. Journal of the Fisheries Research Board of Canada <u>14</u> , 775-782 (September 1957) (Abstract of this article appears under 2, 01 page 3 - March 1958)	2. 9	PARALYTIC SHELLFISH POISON. VI. A PROCEDURE FOR THE ISOLATION AND PURIFICATION OF THE POISON FROM TOXIC CLAM AND MUSSEL TISSUES Schantz, Edward J.; Mold, James D.; Stanger, D. Warren; Shavel, John; Riel, Frank J.; Bowden, John F.; Lynch, Joseph M.; Wyler, Ruth Savage; Riegel, Byron; and Sommer, Hermann Journal of the American Chemical Society <u>79</u> , 5230-5233 (October 5, 1957) (Abstract of this article appears under 7, 599 page 19 - March 1958)
0. 5	THE EFFECT OF SALT CONCENTRATION ON THE BIOCHEMICAL REACTIONS OF SOME HALOPHILIC BACTERIA Gibbons, N. E. Canad. J. Microbiol. <u>3</u> , 249-255 (1957) Food Science Abstracts <u>29</u> , 312 (August 1957) Tests with a number of halophilic bacteria indicated that their degree of pigmentation, surface texture of the colonies ability to hydrolyze proteins and starch, and ability to produce indole and hydrogen sulphide varies with the concentration of salt in the medium.		

3.12 REQUIREMENTS FOR USE OF PRESERVATIVES AND COLORING AGENTS IN FISHERY PRODUCTS Ludorff, W. (W. German Fishery Research Sta., Hamburg, Ger.) <i>Fischereiwelt</i> 1957, 20-3 (1957) (in German) <i>Chemical Abstracts</i> 51, 13257 (September 10, 1957) A review. 3.12 THE USE OF AUREOMYCIN IN HANDLING FRESH MARINE FISH Kreuzer, K. B. (West German Fishery Research Sta., Hamburg, Ger.) <i>Fischereiwelt</i> pp. 17-20 (1957) <i>Chemical Abstracts</i> 51, 13256 (September 10, 1957) Aureomycin ice is of no value in preserving initially off-quality fish. There is a discussion about destruction of aureomycin in cooking and the health significance of residues. 3.12 APPLICATION OF VITAMIN C. I. PRESERVATION OF FRESH FISH WITH ASCORBIC ACID Inagaki, Choten and Iechika, Keiko (Ochanomizu Univ.) <i>Eitō to Shokuryō</i> 6, 82-4 (1953) <i>Chemical Abstracts</i> 51, 18375 (November 25, 1957)	3.2491 ON THE FROZEN MEAT OF SWORDFISH Tsuchiya, Y. <i>Proc. 9th Int. Congr. Refrig., Paris</i>, pp. 4 051-4 057, 4 092-4 095 (1955) <i>Food Science Abstracts</i> 29, 421 (October 1957) The effect of various freezing conditions on the green discoloration of frozen swordfish was investigated. Fillets were washed, frozen at -31° C. for 32 hours, at -27° C. for 48 hours, at -24° C. for 50 hours or 74 hours, and at -19° C. for 50 hours, glazed, stored at -16° C. for a month, and then examined. Lower freezing temperatures had no significant effect on the discoloration. More volatile basic nitrogen was present in the green fish than in normal fish. The discoloration probably depends mainly on the freshness of the fish before freezing. 3.2491 FROZEN FISH, QUALITY ASPECTS Heen, E. <i>Proc. 9th Int. Congr. Refrig., Paris</i>, pp. 4 046-4 050, 4 092-4 095 (1955) <i>Food Science Abstracts</i> 29, 422 (October 1957) Recent studies on the process of freezing and the effects of freezing on fish muscle are reviewed, with particular reference to changes in quality during storage, due to dehydration, oxidation, and denaturation, and to methods of improving the quality.
3.19 THE DESTRUCTION OF THIAMINE IN MEATS AND IN AQUEOUS SOLUTION BY GAMMA RADIATION Choninger, H. S. and Tappel, A. L. (Department of Food Technology, University of California, Davis) <i>Food Research</i> 22, 519-523 (September-October 1957) Thiamine is destroyed in meats and in aqueous solution by gamma irradiation. Irradiated aqueous thiamine solution is yellow-colored, fluorescent and has an odor of burned rubber or thiazole. The primary reaction occurring during the irradiation of thiamine is the formation of thiazole. Probably from the 6-amino group of the pyrimidine moiety or from the thiazole and pyridine ring nitrogen. Paper chromatographic separation indicated that two main degradation products are formed during irradiation. Attempts to characterize these products using their absorbance spectra have been successful. 3.19 NUTRITIVE VALUE OF IRRADIATED TURKEY 1. GROWTH-PROMOTING QUALITY AND BIOLOGIC VALUE Calloway, Doris Howes; Cole, Edmond R.; and Spector, Harry (Quartermaster Food and Container Institute for the Armed Forces, Chicago, Illinois) <i>Journal of the American Dietetic Association</i> 33, 1027-1029 (October 1957) The biologic value and protein digestibility of turkey preserved by 2, 3, and 6 megarep of gamma irradiation or by heat was assessed, using the nitrogen balance technique in rats. Neither irradiation nor cooking altered the biologic value of the turkey protein.	3.2493 FRESH FISH 5. FROZEN FISH STORED WITH ICE CREAM Dreosti, G. M. and van der Merwe, R. P. <i>Fishing Industry Research Institute, Cape Town, South Africa Ninth Annual Report</i>, pp. 9-10 (1955-1956) Samples of smoked cod, fish sticks, hake fillets, and cod fillets and chocolate- and vanilla-flavored ice cream were brought to their final storage temperatures separately before they were placed together in sealed containers that were held at 0° F., 10° F., and 18° F. The samples were stored wrapped, or in closed cartons, or removed from their wrappings to allow free contact with the surrounding common atmosphere. All of the products were examined after two weeks' of storage. No tainting could be detected in any of the samples fish or ice cream. 3.2493 TIME-TEMPERATURE TOLERANCE OF FROZEN FOODS XII. TURKEY DINNERS AND TURKEY PIES Hanson, Helen L. and Fletcher, Lorraine R. (Western Regional Research Laboratories, Albany, California) <i>Food Technology</i> 12, 40-43 (January 1958) Turkey dinners and turkey pies, both laboratory and commercial preparations, were evaluated for flavor and other changes after storage at temperatures ranging from -30° to 20° F. Stale and rancid flavors developed in from 1½ to 3 months in samples held at 20° F.

3. 337 REFLECTANCE SPECTRAL STUDIES OF THE HEMATIN PIGMENTS OF COOKED BEEF Tappel, A. L. (University of California, Davis) Food Research <u>22</u>, 404-407 (July-August 1957) The hematin pigments of meats have relatively sharp and characteristic reflectance spectral minima. Reflectance spectrophotometry is a very useful technique for measurement and identification of the hematin pigments in meats. The brown pigments of cooked beef are best characterized as mixed denaturated globin nicotinamide hemichromes. Their conversion to various hemochromes is discussed.	4. 69 THE ROLE OF TOCOPHEROL CONTENT IN THE COMPARATIVE STABILITY OF CHICKEN AND TURKEY FAT Mecchi, E. P.; Pool, M. F.; Behman, G. A.; Hamachi, M.; and Klose, A. A. Food Science Abstracts <u>29</u>, 120 (April 1957) The fact that turkey fat is less stable than chicken fat has been attributed to its lower content of tocopherol. Addition of 0.1% of tocopherol to the diet of turkeys and chickens for 5 or 10 weeks increased the tocopherol content of the fat of both species, and also the stability as measured by the induction period for oxygen uptake, and by chemical and organoleptic tests on carcasses after storage for 9 months at 10° F. (-12° C.); the superiority of chicken fat in tocopherol content and stability was maintained or enhanced.
3. 337 APPLICATION OF SPORE RESISTANCE IN THE NEWER METHODS OF PROCESS EVALUATION Secretist, J. L. and Stumbo, C. R. Food Tech., <u>10</u>, 543-545 (1956) Food Science Abstracts <u>29</u>, 197 (April 1957)	4. 69 FURTHER STUDIES ON TOCOPHEROL CONTENT AND STABILITY OF CARCASE FAT OF CHICKENS AND TURKEYS Mecchi, E. P.; Pool, M. F.; Nonaka, M.; Klose, A. A.; Marsden, S. J.; and Lillie, R. J. Poult. Sci. <u>35</u>, 1246-1251 (1956) Food Science Abstracts <u>29</u>, 120 (April 1957)
3. 5 LARGE NONFACTORY TRAWLER Anonymous Fishing Gazette (Annual Review Number) <u>73</u>, 59 (1955-1956) (Abstract of this article appears under 2.117 page 3 - January 1958)	6. 14 FISH MEAL 10. STORAGE OF FISH MEAL AT ELEVATED TEMPERATURES Dreosti, G. M. and Nachinius, R. J. Annual Report Fishing Industry Research Institute, Cape Town, South Africa <u>9</u>, 27 (1955-1956) A bag of 22-day old pilchard meal was mixed and sampled into open and closed A. 1. Tall cans. Cans containing samples of the meal were stored, respectively, at 32°, 80°, 140°, 180°, 240°, and 300° F. Only the meal stored at 180° F. for 31 days in open cans increased from 73.3 to 71.9 percent in protein and from 6.4 to 3.1 percent in fat. Fish meal held at 180° F. for 30 days was brown but not scorched, whereas the meal held at 240° F. for 24 hours was both browned and scorched.
3. 5 THE CYSTEINE DESULPHYDRASE OF PSEUDOMONAS SALINARIA Baxter, R. M. and Gibbons, N. E. Canad. J. Microbiol. <u>3</u>, 461-465 (1957) Food Science Abstracts <u>29</u>, 427 (October 1957) Pseudomonas salinaris and certain other red halophilic bacteria have been shown to produce hydrogen sulphide during growth in media containing 25 or 30% of sodium chloride, but not in media containing 15 or 20%. Harvested cells of <i>Ps. salinaris</i> contain a cysteine desulphhydrase that, like the corresponding enzyme of <i>Escherichia coli</i>, decomposes cysteine to hydrogen sulphide, pyruvic acid, and ammonia, in the presence of pyridoxal phosphate. Unlike the enzyme of <i>E. coli</i>, that of <i>Ps. salinaris</i> requires high concentrations of potassium chloride (3Molar) for maximum activity.	6. 14 FISH MEAL 13. TEST SHIPMENT OF FISH MEAL Nachinius, R. J. Annual Report Fishing Industry Research Institute, Cape Town, South Africa <u>9</u>, 29-30 (1955-1956) One month old fish meal in bags was shipped under test conditions in two normally ventilated holds of a ship. The 1,740 tons of meal was stacked in blocks roughly 12 x 12 feet square with no stack more than 23 bags high. "Rice ventilators" were used at the rate of 2 for every 5 layers of bags. Temperature of the meal rose from 74° F. at Walvis Bay to 92° F. in the tropics and dropped to 87° F. at Belfast, Ireland. This meal had been loaded at 70° F., exposed to 83° F. in the tropics, and exposed to 50° F. while being unloaded.

LIST OF PUBLICATIONS REGULARLY ABSTRACTED

Analyst	Industrial and Engineering Chemistry
Analytical Chemistry	Industrial Refrigeration
Archives of Biochemistry and Biophysics	Institutions
Biochemical Journal	Journal of Agricultural and Food Chemistry
Bulletin of the Faculty of Fisheries, Hokkaido University	Journal of Applied Chemistry
Bulletin of the Japanese Society of Scientific Fisheries	Journal of Biological Chemistry
California Fish and Game	Journal of Nutrition
Canadian Fisherman	Journal of Organic Chemistry
Canadian Journal of Chemistry	Journal of the American Chemical Society
Canadian Journal of Technology	Journal of the American Dietetic Association
Canner and Freezer	Journal of the American Oil Chemists' Society
Chemical Abstracts	Journal of the Association of Official Agricultural Chemists
Chemical and Engineering News	Journal of the Chemical Society (London)
Chemical Engineering	Journal of the Fisheries Research Board of Canada
Chemical Processing	Journal of the Science of Food and Agriculture
Chemistry and Industry	Maine Coast Fisherman
Commercial Fisheries Review	Modern Packaging
Drug and Cosmetic Industry	Modern Refrigeration
FAO Fisheries Bulletin	National Fisherman
Federation Proceedings	National Provisioner
Feed Bag	Nature
Feedstuffs	Nutrition Reviews
Fisheries Newsletter (Australia)	Pacific Fisherman
Fish. Res. Bd. Can., Prog. Repts. Atlantic Coast Stas.	Pan American Fisherman
Fish. Res. Bd. Can., Prog. Repts. Pacific Coast Stas.	Poultry Science
Fishing Gazette	Practical Home Economics
Food Engineering	Progressive Fish-Culturist
Food Manufacture	Quick Frozen Foods
Food Packer	Refrigerating Engineering
Food Preservation Quarterly	Report of the Food Investigation Board (Great Britain)
Food Processing	Science
Food Research	Southern Fisherman
Food Science Abstracts	Trade News (Fisheries Department, Canada)
Food Technology	Western Fisheries
Frosted Food Field	World Fisheries Abstracts
Gourmet	World Fishing

Articles chosen for abstracting or inclusion as bibliographical references are those deemed of interest to the commercial fisheries and to fishery technological laboratories. Occasionally pertinent articles from sources other than the above listed publications are included. Biological papers are generally omitted.

6.15 FISH MEAL 15. STICKWATER CONCENTRATE AND SEAWEED OR BRAN Dreosti, G. M. and Lewis, A. M. Annual Report Fishing Industry Research Institute, Cape Town, South Africa 9, 30-31 (1955-1956) Various proportions of vacuum-concentrated stickwater containing 40 percent total solids and dried and milled stipe of the seaweed <i>Ecklonia maxima</i> containing 19 percent moisture were combined and dried in conventional fish meal dryers. The maximum amount of concentrate that could be added without producing a lumpy mixture was 1 part of stickwater concentrate to 3 parts of <i>Ecklonia</i>. This material was tacky and had a moisture content of 22.2 percent after being dried and held at room temperature and at 75 percent relative humidity. A mixture of 1 part of 40 percent total solids stickwater and 1 part of bran had a moisture content of 21 percent after being dried and held at room temperature and at 75 percent relative humidity. This mixture, although slightly damp, was free flowing, non-tacky, and pleasant to taste.	6.190 FEEDING STUDY WITH MENHADEN PRESS CAKE Nilson, Hugo W.; Snyder, Donald S. (Fishery Technological Laboratory, College Park, Maryland) Commercial Fisheries Review 19, 11-12 (April 1957) Menhaden press cake, a high-calorie diet, and fresh cabbage have been fed free-choice to five successive filial generations of albino rats for nearly 3½ years. No difficulty has been experienced due to palatability or the numerous bones in the press cake. The rats have been generally very healthy, with the exception of two male third-generation rats that apparently had nervous seizures of unknown origin. The press cake seems to be a satisfactory source of protein for growth and maintenance, and possibly a limited source of some accessory food factors for reproduction and maternal care.
6.15 MODERN EVAPORATORS FOR THE FOOD INDUSTRY Armstrong, C.; Bell, N. R.; and Murray, H. D. Food Manufacture 29, 508-512 (November 1, 1957) It is the purpose of the article to describe the more recent developments in the design of evaporators and at the same time to indicate some of the fundamental aspects of the general problem of heat transfer to boiling liquids.	6.190 THE INFLUENCE OF FEEDING ON FLAVOR, FIRMNESS, AND KEEPING QUALITY OF HOG FAT: FISH MEAL AND GARBAGE COMPARED TO SKIM MILK Dahl, Olle (Scans Centrallab., Malmö, Swed.) Fleischwirtschaft 9, 331-3, 336 (1957) Chemical Abstracts 51, 14159 (September 25, 1957) Fat from pigs fed fish meal or garbage has a fishy or oily flavor, is soft, and has inferior stability as evidenced by organoleptic, thiobarbituric, and accelerated rancidity (55°) tests as well as I nos. Fat from pigs fed skim milk does not have these undesirable characteristics. Such feeding affects back, leaf, and mesenteric fats.
6.19 FISH MEAL 16. EFFECT OF LOW EGG PROTEIN UPON BIOLOGICAL VALUES Willmer, J. S. Annual Report Fishing Industry Research Institute, Cape Town, South Africa 9, 31 (1955-1956) The biological values of four samples of press cake were determined by the method of Miller and Bender (1955), by using as a comparison low diets that normally contained (a) 2.5 percent egg protein, (b) 4.5 percent egg protein, and (c) no egg protein. The differences in biological value were not significant; however, an increase in biological values was shown with an increase in protein concentration in low nitrogen diets.	6.193 UNIDENTIFIED FACTOR RESEARCH REPORTED Anonymous Feedstuffs 29, 23 (August 31, 1957) Chicks fed fish solubles in addition to the regular soybean meal ration gained 12% more than birds on the basic ration at Oregon State College. Dried egg yolk added to the control ration raised gains by 25%. When the dried egg yolk was treated with a fat solvent, the yolk was reduced to two parts. Either part increased growth about half as much as when complete egg yolk was added, indicating that there may be two unidentified growth promoting substances involved.
6.19 TOXIC PROTEIN FROM TRICHLOROETHYLENE-EXTRACTED SOYBEAN OIL MEAL McKinney, L. L.; Weakley, F. B.; Campbell, R. E.; Eldridge, A. C.; Cowan, J. C.; Picken, J. C.; and Jacobson, N. L. The Journal of the American Oil Chemists' Society 34, 461-466 (September 1957) A specially prepared undenatured toxic trichloroethylene-extracted soybean oil meal was fractionated to determine which component of the meal is associated with the toxicity. Call-assay of the samples showed that the toxic factor is associated with the protein and is labile to strong acid hydrolysis. Markable destruction of the toxic factors occurs when the protein is treated with alkali at pH 11-12 at 60°C. Analyses of the toxic protein failed to indicate the nature of the reaction of trichloroethylene with the protein to produce the toxicity.	6.193 STUDIES ON DUCK NUTRITION 6. "UNIDENTIFIED GROWTH FACTOR" SUPPLEMENTS AND METHIONINE IN RATIONS FOR DUCKS Scott, M. L. and Parsons, E. H., Jr. (Cornell University, Ithaca, New York); and Dougherty, Ellsworth, III. (New York State Veterinary College, Ithaca) Poultry Science 36, 1181-1186 (November 1957) Practical duck rations were improved only slightly, if at all, by supplements of fish meal, dried distillers solubles, dried whey, dried fish solubles or methionine, but these supplements appeared, at times, to have a beneficial effect upon leg weakness and feather picking in the ducks 4 to 5 weeks of age.

INDEX

Subject	Page No.	Card No.	Subject	Page No.	Card No.
Analysis, inorganic			Frozen fish, processing		
Fish flavor in pork	27	6,190	Fish-icing techniques	5	2,15
Antioxidants			Modern freezer tunnel design	9	3,2341
Tocopherol and fat stability	25	4,69	Air-blast freezer experiments	9	3,2341
Apparatus and equipment, laboratory and plant			Bacteriology of breaded shrimp	11	3,236
Bone detection by X-ray	19	7,89	Gear, fishing		
Byproducts, miscellaneous			Trends in trawling	3	2,1121
Fish flour	29	6,54	Gear preservation	9	2,111
Protein from fish	29	6,54	Hanging fish nets	11	2,1126
Canned fish, processing			Fish finder aids net setting	21	2,116
Recaptured oyster liquor	13	3,3341	Fishgong fish finder	21	2,116
Hematin pigments cooked beef	25	3,337	Handling fresh fish		
Process evaluation for spores	25	3,337	Meat content of king crab	5	2,3
Chemistry and biochemistry, miscellaneous			Water treatment	5	2,3
Thiaminase	21	0,38	Lobsters		
Cookery			Holding live lobsters	1	1,87
Electronic cooking	7	2,8	Marine plant products		
Fish meal, nutritive value			Harvesting agar weed	19	6,33
Fish meal for broiler rations	17	6,192	Nutrition and medicine, general		
Biological value of proteins	17	6,195	A comparison of proteins	5	0,7
Biological value of fish meal	27	6,19	Nutritional value of fish and toxicity		
Toxicity in extracted meal	27	6,19	Fish-poisoning chemicals	21	2,9
Menhaden press cake for feed	27	6,190	Oils, chemical and physical properties		
Fish solubles increase growth	27	6,193	Canadian technology	15	4,13
Fish solubles in practical rations	27	6,193	Oils, nutrition		
Fish meal and oil, manufacture			Toxic effect of oxidized oils	17	4,92
B. C. herring reduction	17	6,130	Preservatives and sanitation		
High temperature meal storage	25	6,14	Preservative for shellfish	7	3,12
Fish meal as cargo	25	6,14	Antibiotics for whale spoilage	7	3,12
Stickwater concentrate meals	27	6,15	Radiation pasteurization	9	3,19
Evaporators for liquids	27	6,15	Aureomycin for fresh fish	23	3,12
Fishery education			Preservatives in fishery products	23	3,12
Visual lecture aids	29	9,7	Fish preservation with vitamin C	23	3,12
Fishery education in Maine	29	9,7	Effects of irradiation	23	3,19
Permanent fishery exhibit	29	9,7	Thiamin destruction by radiation	23	3,19
Fishing methods			Salt fish		
Mechanical shellfish dredge	3	2,1478	Processing dried salted fish	13	3,5
Freshness of fish			Changes in fat of salt cod	15	3,5
Determination of shrimp quality	19	7,81	H ₂ S producing halophilic bacteria	25	3,5
Determination of methyl mercaptan	19	7,83	Shrimp		
Hedonic scale method	29	7,8	South American shrimp	7	1,85
Routine chemical and bacteriological analyses	29	7,8	Smoked fish		
Routine technological inspection	29	7,8	Comparison of smokes for franks	13	3,4
Taste test design	29	7,80	Hot-smoked fish	15	3,4
Chromatic freshness tests	29	7,80	Frozen smoked anchovies	15	3,4
Bias in flavor preference tests	29	7,80	Spoilage		
Frozen fish, changes in during freezing and cold storage			Respiration of marine bacteria	1	0,5
Drip formation in squid meat	11	3,239	Prevention of jellied swordfish	1	2,00
Frozen storage of plaice	11	3,2490	Bacteriology of fish	3	0,5
Denaturation of fish protein	13	3,2495	Holding fresh oysters	3	2,01
Frozen green swordfish	23	3,2491	Effect of salt on halophiles	21	0,5
Effects of storage	23	3,2491	Rainbow trout		
Fish stored with ice cream	23	3,2493	Trout farming	1	1,37
Rancidity in turkey pies	23	3,2493			

6.54	FISH MEAL 18, FISH FLOUR	7.80	A MODIFIED LATIN SQUARE DESIGN FOR TASTE TESTING
Dreosti, G. M. and van der Merwe, R. P. Annual Report Fishing Industry Research Institute, Cape Town, South Africa 9, 32-33 (1955-1956)	Ferris, George E. (Cornell University, Ithaca, New York) Food Research 22, 251-258 (May-June 1957)		
Laboratory studies directed toward the production of a fish flour with unimpaired biological value have been completed. Pilot plant scale studies have been deferred. The mixed solvent extraction process has been refined and simplified to improve the quality of the final product. Recovery and purification of used solvent for reuse in the manufacture of a neutral fish flour has been simplified and improved to reduce refining operation costs.	One is very frequently interested in the intercomparison of 5 or 6 products. In such cases the conventional latin square design is particularly useful. The columns of the latin square may be the sittings (thus controlling nonproducibility), the rows, the positions in order of tasting (thus controlling fatigue), and the "treatments" are the varieties of the product to be intercompared.		
6.54	THE MANUFACTURE OF PROTEIN FROM HOME-PRODUCED, SO-CALLED "MASS" FISH	7.80	CHROMATIC REACTION FOR JUDGING FRESHNESS OF FISH MEAT
Lorincz, F. Etielmez, Ipar, Budapest 5, 72-75 (1951) Food Science Abstracts 25, 33 (February 1957)	Bortone, L. (Lab. chim. prov., Pescara, Italy) and Testa, C. Attaletica dietetica 1, 9-11 (1956) Chemical Abstracts 51, 9029 (June 25, 1957)		
Of the 8 essential amino acids, 5 have been shown to be present in fish protein. A method was therefore developed for the extraction of protein from lower-grade freshwater fish otherwise little utilized for human consumption. The fish pulp was treated with 1% sodium hydroxide, and neutralized with 3.6% hydrochloric acid to pH 6.6 to 7.0. After purification and evaporation in vacuo, a yield of 102 g. of protein per kg. of fish was obtained (i. e. 62% of the total fish protein). This protein was used as a filler for canned meat products and sausages, and it improved the quality of those products.	The test of Obata and Zana (C. A. 47, 7132a) was found satisfactory for fish such as teleosts, but not for some others such as mollusca and crustacea.		
7.8	ROUTINE INSPECTIONS	7.80	INFORMATIONAL BIAS IN FLAVOR PREFERENCE TESTING
Le Roux, G. J.; Pienaar, A. G.; Edwards, C. A.; van der Merwe, R. P.; and Dichmont, A. D. Annual Report Fishing Industry Research Institute, Cape Town, South Africa 9, 33-34 (1955-1956)	Pettit, L. A. (Food Technology Department, Oregon State College, Corvallis) Food Technology 12, 12-14 (January 1958)		
(1) Frozen rock lobster tails for export, (2) frozen and smoked frozen fish, (3) salted and dried fish, (4) canned fish and rock lobster, (5) tomato paste, and (6) fish meal sampling were subject to routine inspection during 1955-1956.	Information conveyed to, or possessed by, tasters has the potential of altering preference findings of the flavor panel.		
7.8	ROUTINE ANALYSES	9.7	FISHERY SCIENCE ON SHOW
Brodacka, H. J.; Rowan, M. K.; and van der Merwe, R. P. Annual Report Fishing Industry Research Institute, Cape Town, South Africa 9, 34-35 (1955-1956)	Anonymous World Fishing 5, 82, 84, 86, 88 (September 1956)		
Routine analyses made during 1955-1956 were: (1) chemical analyses of fish meals, pilchard meals, maasbanker meals, rock lobster meal, sun-dried rock lobster meal, acidified condensed fish solubles, and stickwater concentrate; (2) bacteriological analyses of salt, water, and fish semi-conserves; and (3) assays of fish liver oil for vitamin A.	The permanent Exhibition organized by the Ministry of Agriculture and Fisheries Research Laboratory at Lowestoft, England shows in a most vivid and interesting way how scientists help the fisheries.		
7.8	HEDONIC SCALE METHOD OF MEASURING FOOD PREFERENCES	9.7	MAINE'S FISHERIES EDUCATION PROGRAM
Peryam, David R. and Pilgrim, Francis J. (Quartermaster Food and Container Institute for the Armed Forces, Chicago 9, Illinois) Food Technology 11, 9-14 (September 1957)	Dow, Robert L. (Marine Research Department of Sea and Shore Fisheries, Augusta, Maine) Fishing Gazette 75, 24, 39 (January 1958)		
The essential features of the hedonic scale are its assumption of a continuum of preference and the direct way it defines the categories of response in terms of like and dislike.	LET THEM SEE WHAT YOU'RE TALKING ABOUT Murphy, Lawrence P. (Wilmington, Delaware) Chemical and Engineering News 36, 67-70 (January 20, 1958)		

